TOPICS OF THE MONTH

Rising rate of capital spending on new plants

ALTHOUGH the rate of increase in chemical output has slowed down recently as a result of the gradual decline in the general level of industrial production, the rate of capital spending on new plants in the United Kingdom is still rising rapidly. When full production figures for chemicals in 1956 are available, it is believed they are likely to show an increase of around 5% on 1955 for the year as a whole—about half the average rate of increase over the previous seven years.

These estimations are made in a review of chemical trade expansion in the *Financial Times* of February 2, which also points out that, despite intense competition in export markets, U.K. shipments of chemicals rose by 5% to a new record of £244 million last year.

The increase in capital spending in the 'chemicals and allied trades' sector of industry will be a considerable one, for capital spending is expected this year to be 23% higher than in 1956. This estimate includes oil refineries and the biggest increases are foreseen for petroleum chemicals, where schemes, totalling some £45 million, are now under construction. British Hydrocarbon Chemicals has now almost completed its £8 million programme for doubling the output of olefines at its Grangemouth plant and Esso Petroleum, Shell Chemical Co. and I.C.I. are also expanding in the petrochemicals field.

Other developments in chemical plants include the I.C.I. Dyestuffs Division 10,000-ton nylon polymer plant at Wilton and the Nobel Division magnesium nitrate plant which, it is reported, will be capable of concentrating 16,000 tons p.a. of weak nitric acid. Developments such as these and new plant which Monsanto Chemicals, the Albright & Wilson Group and Fisons will put into operation or begin work on this year demonstrate that capital spending—which in the first three quarters of last year increased by 43% on the corresponding period of 1955—is not likely to decline in 1957.

Record output for British plastics

THE steady increase of output in the plastics industry has continued in 1956, as was pointed out in our survey of the European chemical industry last month, and the British plastics industry had another record production and export year, it is announced by the British Plastics Federation.

Output, which has been more than doubled since 1950, reached about 335,000 tons, an increase of more than 10,000 tons compared with the 1955 total of 324,000 tons. The increase is at a slightly reduced rate compared with 1955, output for 1954 having been 274,000 tons.

Thermoplastics materials, including PVC, polythene and polystyrene, were again responsible for more than 50% of the output. Expansions now in progress will mean still higher production capacity for various plastics this year and subsequently.

Exports of plastics materials alone in 1956 amounted to nearly 98,000 tons, valued at over £26 million, a rise of nearly 13,000 tons, valued at over £3 million, compared with the 1955 figures, the previous highest. The increase in exports is at a slightly higher rate than in 1955.

The exported materials consist of moulding powders, resins, sheet, rod, tube, film and foil, but do not include finished components and parts, large numbers of which are used in finished products such as domestic ware and parts for the aircraft, electrical and motor industries.

Chemistry and humanity

THE belief that material progress will itself be productive of moral progress and that creative chemistry, by adding to man's material well-being, thereby makes a significant contribution to the humanities, was expressed by Sir Miles Thomas, D.F.C., chairman of Monsanto Chemicals Ltd., in a speech in Toronto recently. The technique of chemical synthesis, Sir Miles stated, may, in the future, come to be regarded as far more important than splitting the atom, which today dominates the scene with sinister implications: 'Synthesis—which is creative chemistry—presents one of the most exciting challenges yet offered to human kind. It presents, to those who are bold and imaginative enough to accept it, the key to a literally new world.'

Outlining some of the fields in which the chemist was actively interested at present, Sir Miles said that better tyres made transport more safe and speedy, that fertilisers, weed and insect killers and other chemicals helped to keep at bay some 50,000 diseases so that man's food and clothing might grow unmolested, while, turning to chemistry's contribution to health, he pointed out that for every new antibiotic or sulpha drug there were scores of less glamorous materials which, in every country of the world, were helping the doctor in his mission of healing.

In conclusion, Sir Miles expressed the humanitarian impulse behind creative scientific research. 'The fulfilment of spiritual needs is a major factor in creating mental and physical well-being but it is indisputable that material needs must be met before the needs of moral progress can germinate. Until all mankind, rather than a chosen few, can live free from want, disease and discomfort, it is of little use to bewail the lack of moral and spiritual standards.'

Competition in fertiliser markets

WITH the expansion of Britain's oil industry and the news of oil company plans to go into ammonia and fertiliser production, severe competition in fertiliser markets is approaching. This was the warning given by Dr. S. W. Saunders, technical managing director of the Billingham Division of I.C.I. in a speech at a dinner given to celebrate last year's record production by the Ammonia Section of Ammonia Works.

During refining operations, Dr. Saunders pointed out, an oil company produces quite a lot of gas containing hydrogen, some of which the company may consider it worthwhile to make into ammonia. He referred to the fact that one of the oil companies is putting up a plant on the Thames to make about 250 tons/day of ammonia. Some of it they would be selling to a well-known firm of fertiliser manufacturers, and the remainder they were going to use for a product of the same general type as Billingham's *Nitro-chalk*, but higher in nitrogen content.

It was developments such as these which made him forecast a period of competition in which increased supply would exceed demand, though he foresaw that, after this difficult period, the steadily rising use of nitrogen fertilisers would bring about a situation when competition would not be so severe. Plans for the future at Billingham itself, included an oil gasification plant which would make hydrogen from almost any kind of crude oil so that it was not dependent on any one area for its raw material, while there were other schemes in hand to put up still more plant.

Harder than diamonds

A CRYSTAL hard enough to scratch a diamond and able to stand twice as much heat, which should prove of considerable importance in industrial polishing and cutting operations, has been produced in the U.S. by scientists of the General Electric Co. The discovery of the crystal, called *Borazon*, has been credited to Dr. Robert H. Wentorf, a 30-year-old physical chemist, who was a member of the General Electric research team which produced tiny man-made diamonds two years ago.

Dr. Wentorf used a similar method to produce *Borazon* crystals the size of grains of sand. He started with boron nitride, commonly called ' white graphite ' and very similar in look and feel to talcum powder. Using pressures above one million p.s.i., he changed the crystals' structure from hexagonal, like graphite, to cubic, like a diamond. Such a cubic crystal, points out Dr. Wentorf, is unknown in nature and is strikingly similar to that of a diamond.

It is stated that, while a diamond ' burns up ' at 1,600°, *Borazon* can withstand 3,500°. It is believed, in addition, that *Borazon's* resistance to oxidation will make possible superior methods of mounting stones in industrial tools and also may allow bits and wheels to be operated at higher speeds, performing their cutting and polishing jobs more quickly and efficiently.

PTFE keeps busy

THE considerable use made of PTFE in the mechanical shaft seal described in our ' What's News ' section this month is just one example of the increasing usefulness of this plastic which, although a high-price material, is made invaluable for certain applications by reason of its remarkable combination of properties. In August 1956 we published an article surveying a number of current applications of polytetrafluorethylene in the chemical and allied industries, but even since that time its scope has widened considerably, as was indicated by an exhibition staged by I.C.I. (Plastics Division) at the company's Millbank, London, headquarters last month. Here the exhibits fell into three main categories—chemical applications, electrical applications and general applications where extremely low friction or freedom from sticking is required.

One exhibit that caught the eye was a 3-in. screwed A-type Saunders valve, cut away to show a *Fluon* PTFE-faced ' 044 ' diaphragm, and obviously very useful for handling highly corrosive solutions. Another was a display of PTFE sheets, rods, cylinders and sleevings while, again, a selection of *Fluon* sheets bonded to rubber, metal etc. suggested to the engineer a great many industrial possibilities of this idea. It is perhaps one of the more intriguing aspects of *Fluon* that it can be bonded to metals or welded to itself by special techniques, but cannot be stuck to other materials by any known method.

I.C.I.'s *Fluon* is now available in powder form as either a granular or a coagulated dispersion polymer. In its granular form it is processed by methods akin to those of powder metallurgy. Preforms are made and then sintered at between 300 and 400°C. This can either be done discontinuously by moulding or continuously by an extrusion process. Coagulated dispersion polymer, on the other hand, is essentially an extrusion material developed for the production of thin-wall tubes and wire coverings. Aqueous dispersions are being developed and one that is in an advanced stage is a general-purpose dispersion for impregnating glass fibre and asbestos, yarns and fabrics. It can also be used for casting film and preparing filled moulding powders.

Uses for PTFE in the chemical field include a wide variety of gaskets, packings, valve seats, washers, flexible couplings, bellows etc., but there are a great many more which have been established or are under development.

Chemical engineering as a career

'CHEMICAL engineering is no "soft option." The study required for qualification is long and hard and it does not cease with graduation.' This is one of the conclusions drawn in a useful guide to careers in chemical engineering published by the Institution of Chemical Engineers.* To show that the hard work required to qualify is worthwhile, the

*'Chemical Engineering—a Career,' published by The Institution of Chemical Engineers, price 2s.

booklet presents a brief survey of the wide variety of duties open to the chemical engineer at different levels of the industry and points out the opportunities chemical engineering offers to an able young man of a new profession destined to play a vital part in providing the food and materials on which the standard of life on this planet in his lifetime will depend.

Five principal ways of training to become a chemical engineer are explained and reference is made to other publications of the Institution which describe these in greater detail. The general impression is of a wide range of opportunity for advancement at every level and this publication should help to recruit more students to the profession.

Local authorities seek tighter hold on trade effluents

A SUGGESTION that local authorities should be given greater control over the discharge of trade effluents into the public sewers, has been put to the Government by the Association of Municipal Corporations, which is urging in a memorandum that the 'prescriptive rights' possessed by many concerns should be abolished, and that the whole of the effluent discharged into sewers should be fully controlled by the local authority.

It points out that continuance of the existing exemptions will make it difficult, if not impossible, for many local authorities to comply with the standards of purity of sewage effluents likely to be required by river boards.

The association's suggestion, which is well backed by other organisations in the municipal field, coincides with the appointment by the Central Water Advisory Committee of a sub-committee to look into this very question. Under present law, many manufacturers of all types who were in business before 1937 have what are known as 'prescriptive rights' to discharge their trade effluents into the public sewer without giving any notice or obtaining any consent, provided certain conditions are observed.

Development of new manufacturing techniques, increased use of detergents and the introduction of various chemicals make sewage purification and the maintenance of drains more difficult, say the authorities in presenting their case for increased control.

Meanwhile, in a speech on 'The Campaign for Cleaner Rivers' at the Institution of Civil Engineers on January 29, Mr. Martin Lovett, Chief Inspector of the Yorkshire Ouse River Board, criticised the design of some new sewage works, which, he claimed, sometimes give the impression that the designer has never been responsible for operating a sewage works at first hand, or has even studied one of his own works thoroughly under operating conditions.

While there are a large number of sewage works incapable of producing effluents even of so modest a standard as that laid down by the Royal Commission in 1908, he said, developments which produce effluents of improved quality were too often being used for the economically more attractive purpose of treating greater volumes of sewage at smaller capital outlay.

'Atomics & Nuclear Energy'

OVERCOMING the many difficult technical problems in the atomic energy field has led, and is continuing to lead, to an enormous number of developments which have benefited other industries and for this reason chemical engineers in these other industries are perhaps almost as much indebted to atomic energy as the atomic energy industry itself is to chemical engineering. Other technologies, such as mechanical engineering and civil engineering, have a similar relationship with atomic energy and so it is that the atomic energy industry has come to be watched as much for the new ideas it produces as for the promised source of power for all.

There could hardly be a better way of keeping up with nuclear science progress than through the medium of our associate journal, *Atomics*, which right from the start, long before atomic power became a reality, has played a leading part in disseminating information about the latest developments in this field, and goes from strength to strength every month. *Atomics*, or, to give it its full title, *Atomics & Nuclear Energy*, has recently emerged with a 'new look' and is now bigger and better than ever before, and is likely to go on being so under its new editor, Dr. F. R. Paulsen (who is the subject of a note in our 'Personal' columns this month).

The current issue of *Atomics & Nuclear Energy* includes articles on welding techniques in atomic energy plants, liquid metals and nuclear power, nuclear power and gas turbines, the new nuclear power station for Hunterston, and the determination of archaeological ages by means of radioactive carbon.

Progress report on Calder Hall

THE only unexpected difficulty which has occurred at Calder Hall nuclear power plant during its many months of operation is that the leakage of carbon dioxide from the system is larger than was anticipated. This leakage, however, involves no hazard whatsoever. It is taking place at points such as the glands of valve spindles and is progressively being remedied by conventional engineering methods. Because carbon dioxide is comparatively cheap the cost of the additional amount required to make up the loss will make no material difference to the cost of operating the station.

The whole of the 'A' station at Calder Hall is now operating. Reactor No. 2 has begun to supply electricity to the national grid system, and this has increased the total generating capacity of the plant from 46,000 kw. to 92,000 kw. installed. Sir Christopher Hinton, at a press conference recently, stated that the nuclear behaviour of the plant has been good—the critical size was less than calculations had predicted.

Generally, he reported, the performance of the fuel elements has been better than was anticipated. There are, of course, a very large number of fuel elements in a nuclear reactor, and a small percentage of faulty elements must be expected. This percentage had been established on the Windscale reactors and, by using this information, a prediction was made for

those at Calder Hall. The usual fault is no more than a pinhole, which leads to a small escape of radioactivity in the coolant gas. This is quickly detected by the leak detection gear, and the element is replaced. The rate of failure to date is lower than the predicted figure.

The most interesting point in connection with the elements which is still under investigation is their deflection or bowing under load. In the Calder Hall reactors the fuel elements are stacked one on top of the other and the lower elements are, therefore, loaded with the weight of those above. On the other hand, because the coolant enters the reactor at the bottom, these fuel elements are at a fairly low temperature.

When the reactor was being designed, Sir Christopher pointed out, the rate at which these lower fuel elements would deflect under load was calculated and found to be satisfactory in the light of the knowledge which existed at that time. Not long before the reactor became divergent, however, it was suggested, as a result of an extremely able piece of pure research work done at Harwell, that the rate of bowing of these lower fuel elements might be greater than had been allowed for. This theory could only be investigated by examination of fuel elements which had been exposed in the reactor. To secure the necessary information the reactor has been closed down on one occasion and fuel elements have been removed for examination. The general condition of these fuel elements is excellent, but they do show that the Harwell theory is at any rate partially correct. This gives rise no no anxiety, since it is easy to modify the method of supporting the fuel elements in a way which will give completely satisfactory results.

The fuel elements have been in reactor No. 1 since June and, during the intervening period, the Authority's engineers have developed an improved method of support which will reduce the amount of distortion.

This improved type of element has been introduced into reactor No. 2, which is now in full operation. In the near future reactor No. 1 will be due for its next routine shutdown and the replacement fuel elements which will then be inserted will be of the modified design.

The overall picture of the operation of Calder Hall during 1956 is, therefore, that of a plant which, in spite of its pioneering nature, has gone into operation smoothly and satisfactorily and which is fulfilling all the best hopes of its designers.

Enriching slag

BASIC open-hearth slag can be split up into a manganese-iron-rich magnetic fraction, and a lime-phosphate-rich non-magnetic fraction, by employing the Sylvester method. This is accomplished by correcting the basicity of the slag to about 2 by adding either lime or silica, depending upon the composition of the slag, and firing the mixture to just below its fusion point. The two fractions can be separated by magnetic separation after fine wet grinding. Iron and manganese could be recovered from the magnetic fraction and the non-magnetic, phosphate-rich fraction could be utilised as a fertiliser.

The application of this process for the enrichment of Duplex slag with respect to its P_2O_5 content for use as a fertiliser has been studied and the results are presented in a paper by Ravindra Singh Mathur, H. V. Bhaskar Rao and Rabindar Singh in the *Journal of Scientific Research*, 1956, **15A**, 463, published in New Delhi. It was discovered that correcting the basicity of the slag to about 2 by the addition of 3% silica to the slag, and firing the mixture at 1,350°C. increases its citrate-soluble phosphate content from 3.87% to 5.70%. The minimum crystal size and the intimate interlocking of the constituent minerals hinder the magnetic separation of the phosphate-rich phase on the treated slag.

Digital computer in an oil refinery

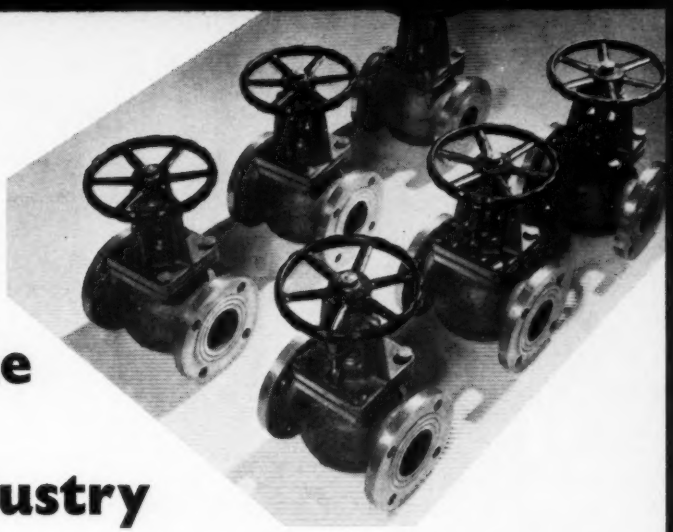
IT is difficult to predict in advance whether a computer will pay for itself in an oil refinery, but this has, in fact, been found to be the case at Fawley in one of Britain's largest plants. Two novel types of application for such a machine, both of which may save much money, are described in the March issue of our associate journal *Automation Progress* in an article by B. D. Dagnall and P. Mayers of the Esso Petroleum Co.

The first problem is the determination of the optimum operating conditions of a plant and, according to the method described, it falls into three parts: determining the rules by which the performance may be calculated from the operating conditions, which is known as setting up the mathematical model; devising a computer programme to carry out the calculation; and, selecting each set of trial conditions, by reference to earlier results, to get as big an increase in response as possible.

A similar method is followed in the second application, which is a management study concerned with the determination of the required peak capacity of proposed new equipment by means of the computer. When the provision of new plant is under consideration it is often difficult to decide on its size because of the fluctuations in the demand. Taking as an example the case of stocks, the authors point out that the size of these should be such, not that any conceivable demand can be met, but that the cost of holding additional stocks exceeds the loss suffered on the occasions when the item is needed, but not in stock. It is in giving some measure of the fluctuations in demand for such facilities that the computer can be of use, especially where the fluctuations are due to random effects, such as weather.

Illustrating this application of the digital computer with an example based on crude oil stores, the authors demonstrate that a series of trial runs can be carried out on plant which does not, in fact, exist. They claim that this application is not spectacular, since it does not involve the use of much mathematics and does not obtain answers which could not possibly be obtained otherwise.

The Role of Special Nickel-based Alloys in the Chemical Industry



This article discusses the problems of choosing suitable metals for particular applications where corrosive chemicals are involved and gives a useful summary of the properties and applications of a series of special nickel-based alloys.

THE choice of a metallic material to withstand the combined corrosive action of the mixtures of chemicals used in modern processes has become a complex matter, made more difficult by the wide range of such materials on the market. This article will seek to show how such a choice can be made and will discuss the merits of a range of nickel-based alloys for those duties where the long-established and readily available iron- and copper-based materials are of no avail.

Certain criteria naturally govern the choice of a material for a particular duty. Of these

(*a*) Service life of the material;
(*b*) Cost and weight;
(*c*) Ease of machining and fabrication; and
(*d*) Availability

are thought probably the most important and are so listed. However, the final selection of a material depends on the answers to all the questions posed being reasonable rather than the answer to any one being particularly favourable. Thus, mild steel is a very cheap material, but its resistance to hydrochloric acid is indifferent and its use for chemical plants handling the acid has been found on balance to be less economic than that of *Langalloy* 4R, which has very good resistance to the acid but is much more expensive. Further, the actual cost of the material will depend on its density; a strong, lightweight, expensive material may prove to be less costly for a section of given mechanical strength than a less expensive but heavier material. Further, the ultimate cost of a particular piece of equipment may well depend far more on the machining and fabricating difficulties than on the material itself. Therefore the choice of a particular material for its corrosion resistance must be tempered by such considerations.

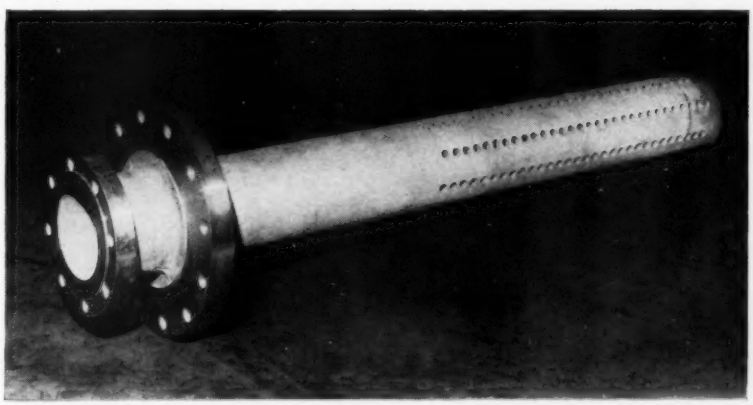
The selection of a particular alloy to withstand the corrosive action of a certain chemical or group of chemicals may be made on the basis of data published by the manufacturers, but more likely it will be on the basis of corrosion tests of one sort or another. In practice the occasions when a single chemical is to be handled will be few, so that the quickest route to a satisfactory conclusion will be a combination of published information and actual testing. Such tests should, whenever possible, be carried out in the actual plant, for, although simulated laboratory tests can reproduce actual conditions up to a point, they cannot anticipate either trace quantities or impurities which may have a marked catalytic or inhibitive effect, or physical disturbances due to temperature gradients and turbulent flow.

Langalloy 'R' nickel-based alloys

This range of commercially available alloys, between them, will withstand the corrosive action of nearly every chemical in industrial use today. Such alloys have been available in the U.S. under the name of *Hastelloy* since 1940 and in more recent years the *Langalloy* 'R' series, alloys of similar com-

▲ **Group of globe valves in one of the range of 'Langalloy' nickel alloys.**

▼ **A steam injector in 'Langalloy 6R' used to inject live steam into sulphuric acid.**



position and properties, have been produced in the United Kingdom.

Constitution and properties

The nominal composition and mechanical and physical properties of the four alloys of the *Langalloy* 'R' series are shown in Table 1. *Langalloy* 4R is an alloy of nickel with 30% molybdenum, which does not readily evolve hydrogen from aqueous acidic solutions in the absence of depolarising agents. It is, therefore, most resistant to corrosion when conditions are reducing, whilst the presence of oxygen or oxidising agents tends to promote attack. Consequently, the alloy is able to withstand the corrosive action of hydrochloric acid extremely well and the rate of penetration rarely exceeds 0.040 i.p.y. The alloy is also suitable for handling sulphuric acid within those ranges of concentrations and temperatures which are not severely oxidising, namely, above about 40% concentration at temperatures up to 150°C.

Langalloy 5R has been developed from the nickel-molybdenum alloy by replacing part of the molybdenum by chromium, thereby rendering the material resistant to strong oxidising media. The strongly adherent and impervious oxide film furnished by the chromium content of the alloy, coupled with the nobility of the molybdenum constituent, enables it to handle wet chlorine and hypochlorites, sulphates, oxidising salt solutions, such as ferric chloride, chromic acid, hydrogen sulphide etc., rather better than other metallic materials. It is also very useful for resisting oxidising acid mixtures, such as nitric and sulphuric, chromic and sulphuric and sulphuric, and copper sulphate and for handling a vast number of complex chemical solutions, including dyestuffs, phosphate rock slurry, fatty acid mixtures and sulphur-dioxide.

Langalloy 6R is an alloy of nickel and silicon and bears little relationship to the other members of the series. It is principally of use for withstanding attack by hot sulphuric acid in the concentration range of 60 to 90% at temperatures above those at which *Langalloy* 4R can be used, but its usefulness is limited by reason of its hardness and tendency to brittleness. The alloy also has been used to handle fatty acids, particularly acetic, most successfully and has reasonable resistance to dilute hydrochloric and phosphoric acids.

In the 7R alloy almost all the molybdenum is replaced by chromium and the alloy represents a further step in the sequence, 4R, 5R, and, whereas *Langalloy* 4R is not suitable to handle nitric acid and the 5R grade is only to a limited extent, *Langalloy* 7R can be used to handle the acid at almost all concentrations and temperatures. Conversely, the 4R grade possesses excellent resistance to attack by hydrochloric acid at all concentrations and temperatures, *Langalloy* 5R only moderate resistance in dilute solutions and *Langalloy* 7R is useful in cold dilute solutions only. However, the presence of 6% copper in *Langalloy* 7R gives the alloy much better corrosion resistance to sulphuric acid than would be supposed from the foregoing remarks, enabling it to be used in all concentrations of the acid in temperatures up to 80°C., for example. It is particularly useful for withstanding the corrosive effects of a variety of acid mixtures, including nitric and sulphuric and chromic and sulphuric, and for mixtures of sulphuric acid and certain salts, such as dichromates. It is largely indifferent to the presence of hydrogen sulphide and sulphur dioxide in aqueous solutions and is, therefore, used in coke-oven by-product plants and petroleum treating units.

Nearly all industrial corrosion problems emanate from the presence of one or more of the acids—sulphuric, hydrochloric, phosphoric and nitric—and the handling of these acids has, therefore, been the subject of intensive study. It follows that this article would not be complete unless the capabilities of the alloys described to withstand such acids were compared.

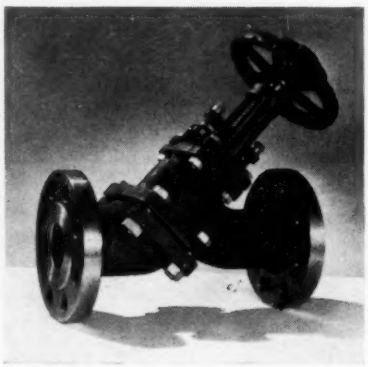
Table I. Composition and Properties of the Four Alloys of the *Langalloy* 'R' Series

NOMINAL CHEMICAL COMPOSITION

	Langalloy			
	4R	5R	6R	7R
Nickel	63	56	85	57
Copper	—	—	3	6
Iron	5	5	—	6
Manganese	.75	.75	—	—
Chromium	—	15	—	23
Molybdenum	30	17	—	6
Tungsten	—	5	—	2
Silicon	.75	.75	10	—

PROPERTIES OF SAND-CAST ALLOYS

	Langalloy			
	4R	5R	6R	7R
Maximum stress, tons/sq.in. ...	32— 36	32— 36	25— 35	27— 31
Yield point	20— 25	20— 25	25— 35	20— 25
Elongation, % on 2 in.	5— 10	8— 12	0— 3	5— 12
Brinell hardness	200—250	180—220	350—400	160—190
Izod impact, ft./lb.	10— 15	10— 15	—	—
Density, lb./cu.in.	.335	.320	.280	.276



Latest type split body, 7 valve 12100.

Sulphuric acid

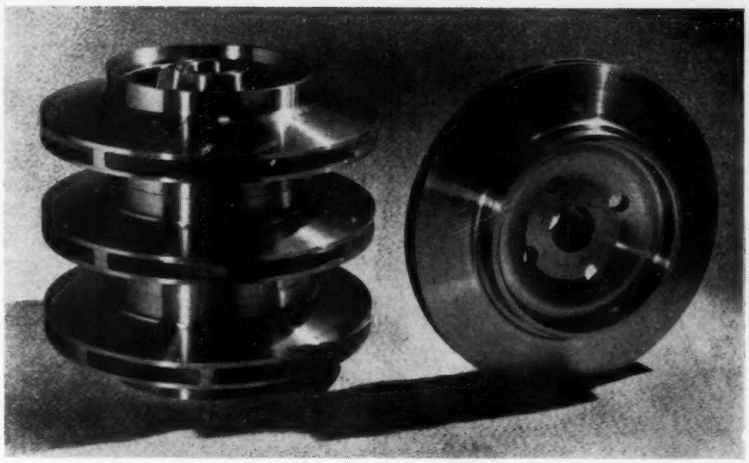
Between them the 'R' series of nickel-based alloys will withstand attack by all concentrations and temperatures of sulphuric acid and by most of the mixtures of chemicals containing the acid that occur in the process and chemical industries. At room temperatures all four alloys will handle the pure acid at any concentration, but if the solution is aerated, then *Langalloy* 5R and 7R are to be preferred. The 5R alloy can be used to handle the acid at concentrations up to 20% at temperatures up to the boiling point, but it is not usually adopted for such services unless the presence of other corrosives demands it, the cheaper and more versatile *Langalloy* 7R being preferred. This latter will resist attack by any concentration of the acid at temperatures up to 80°C. and will handle the boiling acid in strengths of up to 40%. *Langalloy* 4R is the most

suitable alloy for services with the hot acids up to temperatures of 150°C., but it is rapidly attacked by concentrations in the range 60 to 90% at temperatures approaching the boiling point, and in such circumstances *Langalloy* 6R is the only choice, and even *Langalloy* 6R may be fairly rapidly attacked under certain conditions.

Hydrochloric acid

Hydrochloric acid is possibly the most difficult corrosive to handle with metallic materials. The excellent behaviour of *Langalloy* 4R when immersed in the acid is, therefore, of special significance to the chemical industry, for its rate of corrosion does not exceed 0.025 i.p.y. in the boiling concentrated acid in an open system. However, as the maximum concentrations of boiling hydrochloric acid, which is stable in an open system, is 20.2%, higher rates of corrosion can be expected in a closed system under pressure, because appreciably larger amounts of hydrogen chloride can be retained in aqueous solution.

Paddle agitator for use in titanium dioxide pigments (castings in nickel and s.s.).



Group of nickel alloy impellers for use in the chemical industry.

The other alloys of this series have only limited use, *Langalloy* 5R being suitable to handle all concentrations of the acid at temperatures up to 50°C., and *Langalloy* 7R cold, very dilute solutions only. In certain industrial applications there is a possibility of ferric chloride being present in hydrochloric acid and in such circumstances *Langalloy* 4R is not suitable. Provided the concentration and temperature of the acid are within the prescribed limits, *Langalloy* 5R may be used, but otherwise it will be found easier to take steps to prevent ferric chloride forming. Similar remarks apply to the presence of cupric and other oxidising chlorides and also free chlorine.

Nitric acid

The ability of 18/8 stainless steels to withstand corrosion by this acid makes the general use of the more expensive nickel-base alloys unnecessary. However, where nitric acid is used in conjunction with other acids and salt solutions, stainless steels may not be suitable, and in such cases the merits of *Langalloys* 5R and 7R should be considered. The 7R alloy possesses satisfactory resistance to all concentrations of nitric acid at temperatures up to the boiling point, but *Langalloy* 5R is only suitable for dilute acid at temperatures up to 65°C. and for concentrations exceeding 45% at room temperature. The 4R and 6R grades are not suitable for use with nitric acid.

Phosphoric acid

In the cold, chemically pure acid *Langalloys* 5R and 7R are extremely resistant to all concentrations and *Langalloy* 5R is suitable for use in boiling acid of up to 50% concentration, but for higher concentrations at the boiling point *Langalloy* 4R is better. At most concentrations either *Langalloy* 4R or 5R is satisfactory, but as a good general guide the 4R should be used for the chemically pure acid and 5R for the technical acid. *Langalloy* 6R will handle all concentrations of phosphoric acid at temperatures up to about 80°C., but as its mechanical properties are inferior to those of the other alloys it is not used with the acid unless there is a special need for good abrasion resistance or the presence of other chemicals demands its use.

In the manufacture of phosphoric acid by the wet (sulphuric acid) process both *Langalloys* 5R and 7R have been most successful, particularly for pumping slurries where abrasion as well as corrosion resistance is required.

The continued expansion of the British chemical industry and its ability to compete with its American and German counterparts, particularly in the petroleum chemical field, depends on its ability to use strong corrosives under conditions of high temperature and pressure. Only by such means will its products remain competitive. In these circumstances the use of complex metallic materials can be justified economically.

Gas storage. Dealing primarily with water-sealed gasholders, a brochure from Ashmore, Benson, Pease & Co., Parkfield Works, Stockton-on-Tees, gives details of a number of column guided, spiral guided and welded gasholders, as well as ABP-Klonne type dry gasholders and Wiggins dry seal gasholders, which have been supplied to the gas, chemical, petroleum and iron and steel industries.

How to Read Engineering Drawings

1. First Angle and Third Angle Projections

By D. V. Pridham, A.M.I.Mech.E.

Much time and money is saved if there is complete understanding between the chemical engineer and the draughtsman in the various stages of planning a new plant. Here we present the first of four articles designed to show the draughtsman's approach and ways in which the chemical engineer can get his ideas through the drawing stage and on to the actual site more smoothly. This first article considers some basic drawing-office principles and their significance for the chemical engineer; subsequent articles will go into the production of flowsheets and layout drawings, drawing costs, the interpretation of some of the more complicated projections, and other matters.

THE path which leads a chemical engineer to graduation is a tortuous one. It embraces chemistry, physics, mechanical and electrical engineering with perhaps the stiffest hurdle being the utilisation of all this knowledge in the composite technology of chemical engineering. It is no wonder, therefore, that the subject of engineering drawing, so simple in its principles and yet so profound in its effects, has received scant attention *en route*. This subject, however, is of the utmost importance, for it is through this medium that the benefit of sound chemical engineering is translated into hard cash in the shareholders' pockets. By the same token, it may also substantially reduce the value of its function by clumsy or offhand attention on the part of the chemical engineer.

Drawings cost money

It may be worth dwelling for a moment on the actual cost involved in producing a drawing. The average draughtsman costs a manufacturer approximately 3d. per minute when holidays, sickness and office overheads are considered. On this basis many mildly amusing conjectures can be made as to the value of having such things as pencil sharpeners or ready sharpened pencils available for the draughtsman.

It is interesting to realise how much of a luxury it can be changing the denomination 'agitator' to 'stirrer' or changing 'pot' into 'vessel.'

When the question of changing whole layouts arises, cost becomes a matter for very serious consideration. A completed layout drawing will seldom be produced for much less than £100 and may, according to its complexity, cost up to £300. This should never be used as an excuse for permitting a poor layout to occur, but rather it should act as a stimulus to ensure that poor drawings are not produced.

The chemical engineer and the draughtsman

How can the chemical engineer help? A wise man will ensure he is frequently in touch with the drawing office through the appropriate channels. This approach varies from firm to firm. Sometimes it is through the process or mechanical engineer on the project, but in some cases it is directly through the chief draughtsman or even the section leader draughtsman. It is important that the approach is made with due circumspection. Nothing can be more calculated to hinder the progress of a drawing than the draughtsman's receiving instructions and comments from various sources. The direction of a draughtsman is a jealously guarded prerogative and the corns of those invested with it are very sensitive. The chemical engineer who approaches a drawing with the man in charge and who discusses it rather than takes it upon himself to prescribe its form is always welcomed and respected in the drawing office. He is also a wise man, for he will in turn benefit from the draughtsman's observations, which often prove to be of considerable value.

All draughtsmen approach their drawings in much the same way. First the scale of the drawing and the number of views is chosen. Following this, a skeleton of the layout will be lightly pencilled in, giving, with the minimum of detail, the general outline and position in space of the vessels in the case of a layout pipework drawing. It is at this stage that a visit by the chemical engineer is most timely and appropriate. The drawing can be altered without incurring either the loss of much time or the goodwill of the draughtsman, both of which are important.

In the event of considerable alteration, this is the time when the first drawing can be taken off the board and a new one started. When the new drawing has reached this stage, the time is again ripe for the chemical engineer to see it. It gives him an opportunity to confirm his own opinions on the new layout. It also gives him chance to change his mind and revert to the original scheme. The latter he may do without feeling he has wasted the effort put into the alternative. The draughtsman has also had a better chance to come to grips with the plant and will be in a position to contribute even more to the design.

From the foregoing it is clear that a major contribution can be made to the production of a layout drawing before it has reached the stage generally recognised as a drawing.

Subsequently the drawing will add to its skeleton vessels skeleton pipes, valves, etc. At each stage it is worth a visit from the chemical engineer and as each section is agreed the skeleton is ' drawn in,' becoming more like the drawing that ultimately leaves the board.

Reading a drawing

If a chemical engineer is to make his most useful contribution he must be able to recognise and ' read ' not only the finished drawing but drawings in the course of preparation. To many chemical engineers a drawing is something they recognise but do not readily understand. It takes a mammoth effort of concentration to follow it in detail and often they prefer to have a drawing ' explained ' to them. For these unfortunates the visits to the drawing office in the early stages of a drawing will be as much a waste of their time as it will be of the draughtsman's. What is more serious is that they will not appreciate details regarding the layout of their own plant until the drawing is in an advanced stage, when this discovery will cost much time and money.

The reading of drawings is very similar to the reading of technical articles (at which all chemical engineers surely excel). The more drawings are read the easier it becomes to understand them. They all have basic rules which hold good even though their presentation may differ. The purpose of this series of articles is to explain and refresh in the minds of chemical engineers the principles, techniques and pitfalls associated with the preparation of engineering drawings without which the plant cannot be built and through which the hallmark of brilliance or mediocrity will be indelibly stamped on their work.

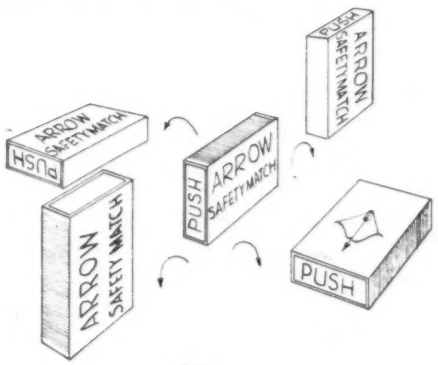


Fig. 1.

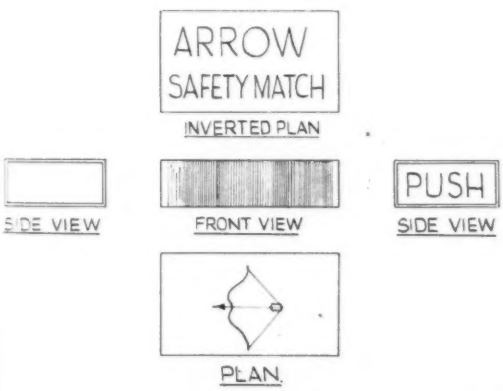


Fig. 2.

Projection

In Britain the traditional projection has been that known as ' first angle.' The British Standard Specification No. 308 on ' Engineering Drawing Office Practice,' first issued in 1927, specified the use of first-angle projection and only permitted the use of third-angle projection for ' special reasons.' This condition remained firmly established in most drawing offices until the outbreak of the second world war. As the result of the United States entering the war there was a considerable interchange of drawings between the U.S. and the U.K. The standard method of projection used in America is third angle and, in consequence, it became commonplace to find drawings being produced in this style wherever there was the likelihood of interchange occurring. In fact, the Ministry of Supply drawing offices adopted completely the method of third-angle projection as the result of a directive to Government drawing offices issued in 1948. In the same year the British Standards Institution issued an amendment to their specification No. 308 acknowledging that both first- and third-angle projection were in use in Britain and giving its blessing to the use of either method.

First-angle projection

Let us consider, with the aid of Fig. 1, the principle of first-angle projection using some simple everyday article such as a matchbox. For the purpose of identification let us assume that on one face of the box the words *Arrow Safety Match* appear, that on the other is an emblem of a bow and arrow and that the box has only one striking surface. To identify the ends of the drawer let us assume that one end has the word *Push* printed on it while the other is plain.

Stand the box on its non-striking surface and look directly on the top of it. The view would be that of a rectangle with a rough surface which could be chosen for your front view. If the box is now toppled over so that it falls on the face bearing the words *Arrow Safety Match*, the orthodox plan view is obtained. This would be a rectangle with the bow and arrow emblem showing. Return the box to its original position, *i.e.* standing on its non-striking surface, and repeat each of the toppling manoeuvres in turn. A drawing of the matchbox in first-angle or English projection, as it is sometimes called, will be produced as shown in Fig. 2. It will be noted that no view of the non-striking edge of the matchbox has been shown. If required, this may be shown by a further ' toppling ' of any of the views. It would usually be one of the side views which underwent this, although the selection of the view would be governed by the shape of the finished drawing format.

First-angle drawing is characterised by the fact that the plan view is always to be found underneath the front view. An additional characteristic is that the view of any side of the front view is always remote. In other words, when we consider Fig. 2 it will be seen that a view of the left-hand side of the front view (the side that would have the word *Push* on it) is to be found on the right-hand side of the drawing. This is the case for all the other sides of the front view. For instance, the view of the top side, or plan, is to be found at the bottom.

In many cases it is a disadvantage to have views remote from the sides to which they refer. This always requires the view to be projected across the front view, with the result that any projection lines used deface the front view and have to be carefully removed on completion of the drawing. In addition to this, inaccurate projection of side views becomes more likely on drawings where the front

view is of necessity long. It is this latter feature which more than any other makes third-angle (or American) projection attractive for the preparation of drawings where the front view is of necessity long.

Third-angle projection

With the use of the same matchbox as in Fig. 1 let us examine the technique of third-angle projection.

Choosing the same front view with the box standing on its non-striking edge the box is gripped at the bottom and laid on its lettered face so that the bow and arrow symbol appears uppermost and the striking surface is nearest the front view as in Fig. 3. The resulting view of the rectangle with the bow and arrow symbol remains the plan, but on the drawing, Fig. 4, it now appears above the front view. Return the box to its original position standing on its non-striking surface and repeat the manoeuvres for each of the four views, ensuring each time that the striking surface is pointing towards the front view. The finished drawing will be as shown in Fig. 4, giving similar views to the first-angle projection but in different relation to one another.

This, then, is third-angle (or American) projection. Should the additional view of the non-striking edge of the box be required it can be obtained by a further manoeuvre of any of the views. As for first-angle projection, the view chosen is usually an extension of the side view, although a further view above the plan is frequently chosen.

The benefits of third-angle projection are pointed out in B.S. Specification No. 308 in that ' particular features displayed in any two views are generally in close juxtaposition and thus it is easier to project one from the other when drawing and so associate them clearly in dimensioning or reading . . .'

The choice of projection

Both methods of projection have features which commend them and for this reason they are commonly found in use in drawing offices throughout the United Kingdom. Some drawing offices use one method exclusively, while others vary the projection according to the client's wishes or the nature of the work in hand. In no case, however, should a drawing appear with part first-angle and part third-angle projection on it. Every drawing should have clearly stated on it the method of projection being employed and it is as well to look for this before trying to read the drawing.

Frequently it is unnecessary to give all the views available. A good draughtsman will always aim at producing a drawing which will convey all the necessary information for manufacture with the minimum of drawing and dimensioning on it. Take, for instance, the case of a tubular vessel such as a tower. Assuming it has no side branches the front view and the two side views will be identical. It would therefore be customary to give only the front view. If the top and bottom ends were identical, then only the plan view would be given. This would reduce the drawing to two views, but these would be sufficient for manufacture of the tower. It is always interesting to study a drawing to see if any of the views are superfluous. These superfluous views cost 3d. per minute to produce. On the other hand, it is as well to remember that lack of information on a drawing can cost much more.

Sectional views

The choice of either first-angle or third-angle projection may not solve the problem of giving all the information through the orthodox views of these two methods. It is at this stage that additional views begin to appear on a drawing which cannot be reconciled with either projection. One of these is the sectioned view. Here the draughtsman has shown an item as if it were cut in half. His reasons for doing so are numerous. He has perhaps saved the drawing of several more orthodox views. He may have found it easier and clearer to illustrate internal fittings in this way, as it is the practice in engineering drawing to show anything which is below the surface in broken lines. By cutting the item in half he has ' removed ' the surface which was hiding the internals and has by this means been able to illustrate them fully.

Not all sectioned views are pictures of the article cut in half. They can be views of cross-sections at any ' depth ' through the drawing. The exact depth through which

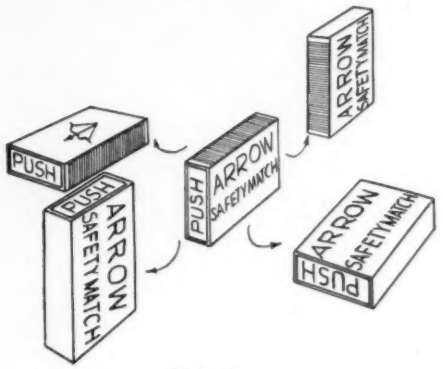


Fig. 3.

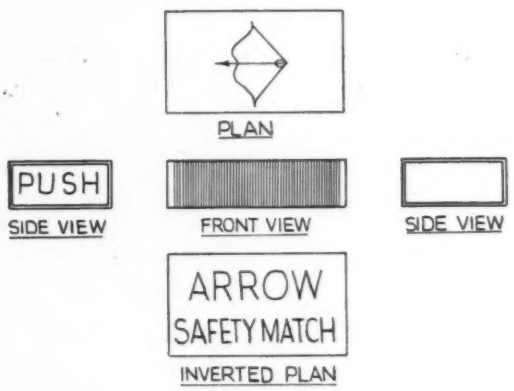


Fig. 4.

such a section is taken is always indicated on one of the other views. A sectioned view always carries a title such as ' Section Thro' AA.' On one of the other views will be seen a line passing through the item with arrows on each end of it and the letters AA (or whatever letters were nominated) adjacent to the arrows. This is illustrated in Fig. 5.

Further to this it is sometimes convenient to give drawings of internals at varying cross-sections. These are often illustrated on one view which generally carries the name of ' Section Elevation.' An example of a part sectional elevation is given in Fig. 5. From such an elevation much information can be given on one view with a consequent saving of time and space. Another variation on this theme is to give a part section or broken

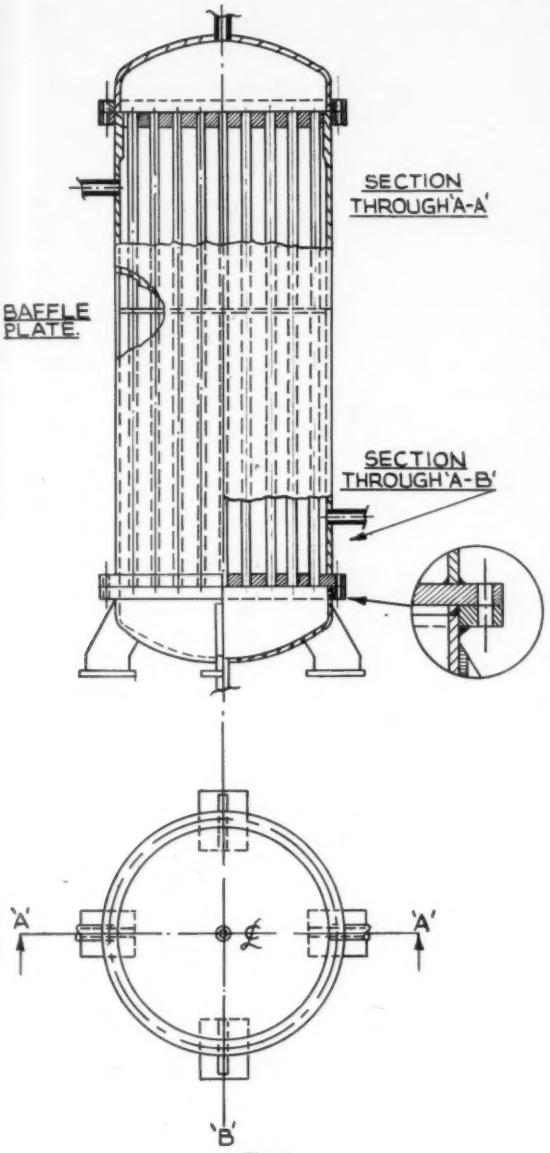


Fig. 5.

section. This usually takes the form of appearing to break away a small part of the concealing wall to enable a point of local detail to be seen clearly as, for instance, the tube baffles on the heat exchanger shown in Fig. 5.

Section drawings and drawing office conventions

The method of showing broken sections is a common one frequently employed in illustrated brochures and is therefore readily understood by most. It is important to remember, however, that on a drawing the exact location of a sectioned view is always shown on one of the adjacent views so that it positively dimensions the depth at which the section is given. This should always be established before studying the section. There are, however, some conventions regarding the illustration of sections on engineering drawings which can at first sight be a little confusing. When a section line passes through a web or gusset the line is always assumed to come sufficiently forward so as not to cut the web. Therefore in the sectioned drawing only the main member is shown sectioned and the web or gusset appears to be behind it. A sectioned article is always indicated as being cut by having its face filled with ' hatching '—sloping lines usually inclined at 45°. It is also customary to section only that which is necessary to give the information and, even though a section line may pass through the component it is revealing, the component itself is usually shown as being whole. Both these techniques have been illustrated in Fig. 5.

Although it is customary to hatch all parts which are considered as being cut during sectioning, hatching is often omitted in the case of thin-wall sections where the hatching lines would be very short. Sometimes these thin walls are completely blacked in and in other cases they are left untouched. This may be termed as draughtsman's licence, although a sectioned view should always be presented in such a way as to ensure the reader will be quite clear as to what has been sectioned.

Special views

Special views and scrap views, as they are sometimes called, are the draughtsman's way of avoiding the preparation of a number of extra orthodox views just to show particular details. In the case of a special view this is usually a non-orthodox view and is clearly named ' View on AA ' as in the case of a sectioned view. Once again arrow heads marked with the appropriate letters indicate both where the view is taken from and in which direction the viewer would be looking. These arrows will appear on one of the orthodox views elsewhere on the drawing. A scrap view, as its name suggests, is an incomplete view drawn simply to clarify an item of detail. It need not follow the laws of projection that the rest of the drawing obeys and is sometimes drawn to a different scale from the rest. Because these views usually break all the laws of projection their use is generally restricted and the part to which they refer is made abundantly clear.

Finally, let us consider the sketch of the heat exchanger shown in Fig. 5. It is not meant to be the drawing of an orthodox heat exchanger and is only drawn to provide an opportunity of illustrating some of the drawing techniques adopted. It will be noted, however, that the addition of some dimensions and perhaps a few explanatory notes would be sufficient to enable a manufacturer to produce the article from these two simple views.

We have the exchanger shown as a sectional elevation with an orthodox plan view below it. The fact that the plan view is below establishes the projection as being first angle (or English). The top half of the drawing is shown hatched and carries the note ' Section Through AA.' Reference to the plan establishes this as being the east-west centre line and the top of the vessel is therefore a view of the exchanger cut in half. It will be noted that, although the vessel is cut in half to show the exchanger tubes, these are left ' uncut.' Below this section through AA is a ' broken section ' revealing the baffle plate with the exchanger tubes passing through it. At the bottom of the sectional elevation is another section, this time designated 'A—B.' Reference to the plan view shows this to be simply a quarter of the exchanger cut away. It will be noted that, although the cut is on centre line AA, which would slice the supporting leg with its foot in half, there is no hatching on these parts. The final unorthodox view is the scrap view giving in enlarged scale a closer look at the welding arrangement of the flanges and supporting leg.

Safety Matters

Cleaning Operations

By H. Allen

CLEANING is an essential operation that is not without its hazards in some locations, as where tanks, vats, containers, pipes and so on are treated with steam or water. The hazards include explosion risk (arising from high pressure in the generating equipment), bursting of hose and contact of electrical conductors with water.

One of the chief causes of reported accidents has been the careless connection of a hose to the steam line instead of to the water line. This points to the first basic precaution: that of installing only one connection —a water connection—for the hose, with all water and steam lines hooked up as a permanent pipe installation to the heating element. In addition, a mixing valve can be permanently installed.

Water heaters and steam generators should be regarded for safety purposes as boilers and fitted with safety valves. All water and steam lines should have control valves so that pressure will not reverse the flow and cause the steam to drive into the cold-water system. A needle or globe throttling valve is much safer than a plug valve; the latter is unreliable in throttling a steam line because it does not have enough volume control and because steam may flow too suddenly and at too great a pressure.

Care with hoses

Pressure in relation to the hose is highly important. It is essential to use only wire-reinforced steam hose so that the hazard of a burst under high pressure is scotched. In such hose, all connections are heated. It is wise also to consult manufacturers about the specifications of hose for a given job.

All hose must be clearly identified and personnel instructed in immediate recognition of the identification marks. Colour and coding and/or wording can be used to ensure that steam hose is used for steam cleaning and that cold-water hose is never applied for steam-washing purposes.

Inspection and maintenance of the hose are also salient points in the safe-working programme. Routine inspection will detect cracks and blisters. Kinked hose can be hazardous and correct handling is important as well as proper storage. Hose should be coiled for storage and hung up on a rack or reel; to leave it lying haphazardly about is to ask for trouble. Hose connections need to be carefully checked to ensure that they are in good condition; loose connections may cause steam or boiling water to spray over an operator.

Hazards from scalding and electric shock

Water temperature between 180 and 212°F. gives the most effective sterilising action and at that temperature grease is melted and its removal by mechanical action is facilitated. Water at 140°F. can burn skin, however, and whenever cleaning can be efficiently done at lower temperatures that is a sound safety rule.

An important point is involved there; closer breakdown of the job and application of work study to cleaning operations (a territory often ignored in methods study) may well point the way to safer and better cleaning with temperatures lower than those which have hitherto been used in the plant. Washing at a temperature of from 120 to 180°F. will be completely effective with light greases and oil. High-temperature cleaning—at 180°F. and above—is necessary for degreasing work, for much bactericidal operation and for removing carbon-forming materials.

Training of personnel is, as always in safety, basic to the entire programme, but some general precautions will be of help. Identifying steam and water lines with colour codes and words is of assistance and the direction of flow should always be indicated. It is also useful to have handles of different sizes or types for steam and water. The cold-water connection should be on a separate line with no other outlets, so as to prevent a sudden loss of cold water and consequent excessive steam flow when another water outlet is turned on.

The electrical hazard is one that must be squarely faced. All electrical equipment in the area or near the plant to be washed must be inspected to ensure that there are no risks from open switches, wall plugs or sockets. Furthermore, the electrical equipment should either be intrinsically moisture-proof or completely covered against contamination by water. Whenever possible the power should be turned off while the cleaning operation is in progress.

Any equipment which carries steam at high pressure is a vessel that may present hazards; it may explode or the hose may burst. Even at 15 p.s.i.g. pressure, steam has a temperature of 250°F. The safe working rule is therefore to keep the steam pressure as low as possible.

Steam pipelines are best insulated for two reasons. From the safety angle the risk of burns to operatives is lessened and also there is less loss of heat from the steam which may be a cost matter. Operator training will obviously include warning against touching steam lines, but it is wisest to control any latent hazard there by making it a works rule that steam lines within 8 ft. of the floor are insulated with at least ½ in. of insulating material painted in a code colour. High-temperature water should be conducted as near as possible to the point of use in insulated pipes and it is best to keep the hose as short as practicable.

Ventilation and drainage

Ventilation and floor drainage are two other points that must come under consideration in formulating the safety code with steam and water cleaning. Adequate ventilation will dissipate vapour and reduce atmospheric humidity. Floor drainage is mainly a matter of good housekeeping; it has to be stressed, however, that the use of any kind of cleaning material may make a floor surface slippery.

When the air temperature is high it may be necessary to install some method of cooling for operators, but that is a problem that does not often arise in the British climate.

There are several steam cleaners now available which are admirably designed with ' built-in ' safety. Many have automatic shut-offs functioning when the water supply fails; safety valves and so on. So much the better for safety. But it remains management's function to detail the precise safe working code.

Plastics products. A 12-page illustrated booklet surveys the range of plastics materials produced by BX Plastics Ltd., Higham Station Avenue, London, E.4. Rigid sheet, film, flexible sheet and layflat tubing, moulding powders, extrusions and monofilaments are described, with their uses and properties.

SYNTHETIC VITAMIN A

Large-scale Synthesis in Britain

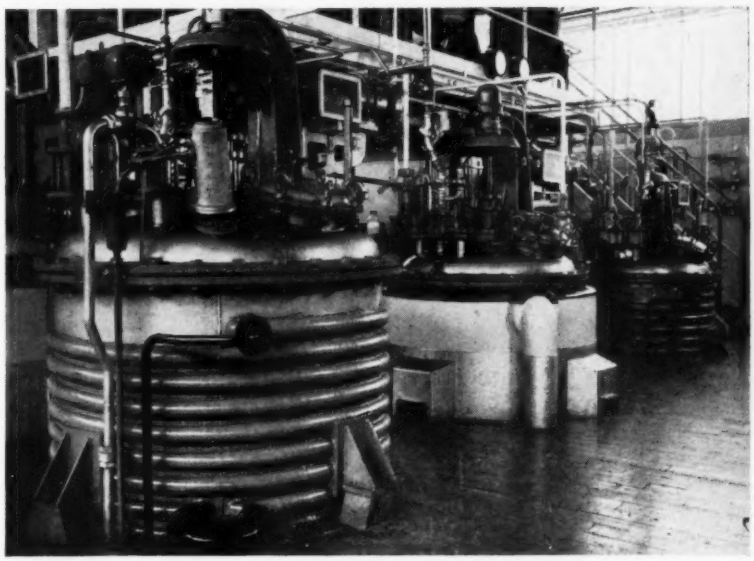
By R. G. Sims
(*Roche Products Ltd.*)

A new Scottish factory of the Roche organisation has begun the large-scale synthesis, for the first time in the British Commonwealth, of synthetic vitamin A, which has a wide variety of applications in the pharmaceutical and food industries. The factory, with its many interesting chemical engineering features, is described below.

EXTENSIVE and ever-increasing work during the last 40 years has led to the isolation, determination of the chemical constitution, and finally the synthesis of the most important vitamins on a commercial scale. Roche Products Ltd. and their associates, in particular in Switzerland and the U.S., have been pioneers in the large-scale synthesis of vitamins, and plants for the manufacture of vitamins B_1, B_2, C and E—not to mention some of the lesser vitamins—have been erected in Britain during the last 18 years.

The latest synthesis of a major vitamin is that of vitamin A, which the Roche organisation achieved 10 years ago.

The structure of vitamin A was elucidated as long ago as 1931 as a result of investigations carried out chiefly by Prof. Karrer, of Zurich, and Prof. Heilbron and his associates in England. It was not until 1947, however, that a really practical synthesis of this relatively unstable and complicated molecule was achieved by Dr. O. Isler and his research team in the Roche laboratories in Basle. Then followed the difficult task of transforming the laboratory synthesis into a plant-scale process. Early in 1950 the major development problems had been overcome and the first large-scale plant was producing to full capacity. Since then two manufacturing units within the Roche organisation—one in Switzerland and the other in America—have helped to meet the growing world demand for synthetic vitamin A concentrates. Now a new Roche plant at Dalry in Ayrshire is coming into production—the first in the British Commonwealth.



Stainless-steel vessels in welded cooling coils at the Roche plant.

A chemical engineering achievement

The large-scale synthesis of vitamin A is generally recognised as an outstanding achievement having regard to the chemical engineering problems involved. Some of the steps involve reactions presenting entirely new hazards and other reactions of great delicacy requiring extremely rigid control.

In its highly purified form, vitamin A is readily susceptible to oxidation. Dr. Isler and his colleagues solved the problems of synthesis by avoiding the preparation of highly unstable multi-conjugated intermediates in all but the final steps. Previously many attempts to synthesise vitamin A have been based on building up the carbon skeleton of 20 carbon atoms step by step. These steps all had the disadvantage that the sensitive structural elements of vitamin A were introduced in the early stages of the synthesis, thus rendering the intermediates highly unstable and exposing them to the destructive influence of subsequent chemical operations.

The process

The principal raw material is citral in the form of lemongrass oil. Essentially the synthesis consists of adding four carbons in 12 steps to the citral—which is a C_{10} compound—to form a C_{14} intermediate. Meanwhile, a C_6 side chain is being built up and this is hooked to the C_{14} intermediate, thus completing the C_{20} structure of the vitamin A molecule. It takes eight of the 12 steps in the synthesis to build up this C_{20} structure.

The following is a brief description of the process:

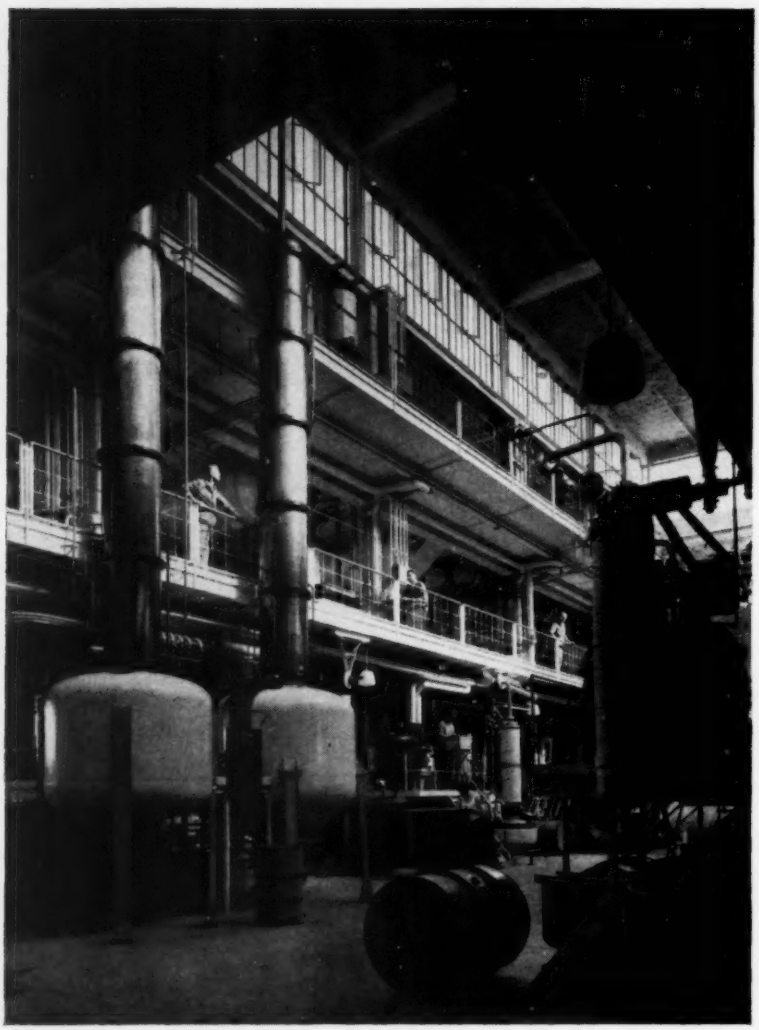
Adding four carbons. Citral is condensed with acetone to yield pseudoionone. The latter is purified by high

vacuum distillation and isomerised with sulphuric acid to *beta*-ionone. This is then distilled under high vacuum and condensed with methyl chloroacetate to yield *beta* C_{14} aldehyde, which is again purified by high vacuum distillation.

Building up the side chain. The C_6 side chain is prepared by reacting methylvinylketone with acetylene in liquid ammonia with the aid of metallic lithium (ethinylation). The resulting tertiary alcohol (methylpenteninol-3) is rearranged in acid medium to yield the primary acetylenic alcohol, methylpenteninol-1. Both alcohols must be carefully rectified in high vacuum.

Combining C_6 side chain and C_{14} aldehyde. *Beta* C_{14} aldehyde and methylpenteninol-1 are combined in a Grignard reaction to C_{20} acetylenediol, which, although it already contains the basic structure of vitamin A, has to undergo several reactions to produce the characteristic system of double bonds present in the vitamin A structure.

Final steps. The triple bond is reduced to a double bond by selective hydrogenation—that is to say, C_{20} acetylenediol becomes C_{20} diol, which then undergoes allyl rearrangement and dehydration to produce vitamin A. In order to protect the primary alcohol group present in the C_{20} diol during the process of rearrangement, the latter has to be acetylated so that vitamin A appears in the form of acetate. C_{20} acetylenediol and C_{20} diol are isolated as crystalline materials. Their purification by crystallisation is important for the production of vitamin A in the purest form.



Solvent recovery units.

Factory site

The considerations which led to the choice of the site for the new British factory were principally the good potential water supply and means for the disposal of effluents, and the availability of labour of the necessary high standard. The site covers an area of 15 acres and the building operations were started late in 1954.

The buildings consist of the main manufacturing unit, effluent neutralising plant, underground tank farm, raw material stores, separate boiler house and office and canteen. They are of a type developed by the Roche organisation for the particular manufacturing operations in which it specialises and will have a familiar look to those acquainted with their main factory at Welwyn Garden City or the plants of the many associated Roche companies throughout the world. In this new factory, manufacture of the first batches of synthetic vitamin A acetate commenced in December and production will be stepped up gradually so that by the middle of this year the plant will be working to full capacity producing the high-potency acetate and palmitate concentrates which are already being widely used here by many food, pharmaceutical and livestock feed manufacturers.

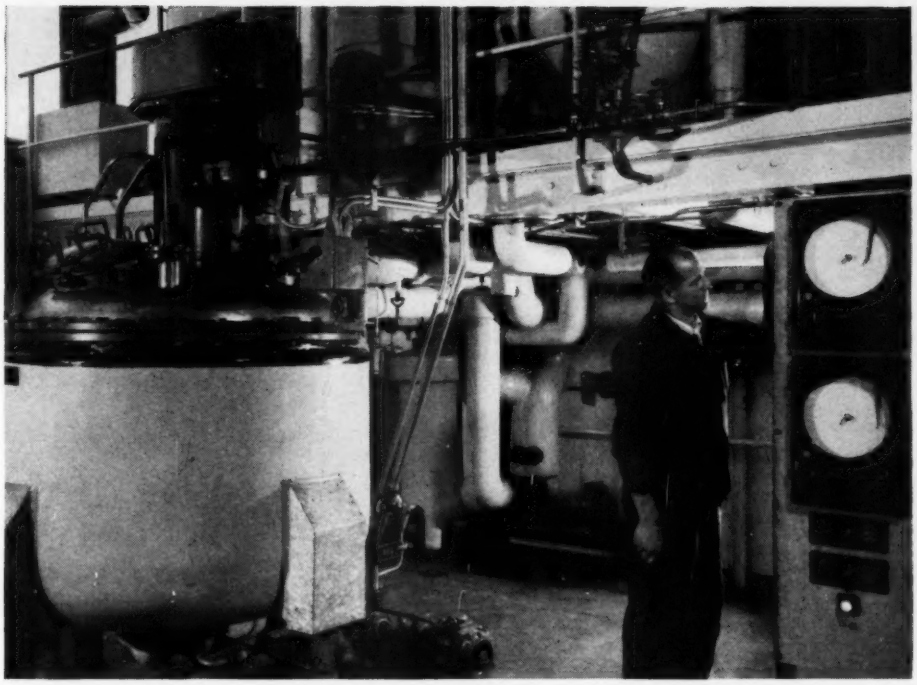
Under normal working conditions the output of synthetic vitamin A concentrates will amount to at least 40 billion international units during a full year's production—equivalent to 40,000 kg. of a 1 million i.u./g. concentrate.

Advantages of synthetic vitamin A

The outstanding advantages of synthetic vitamin A are its purity, uniformity and reliability. It is available in a wide variety of special forms for all manufacturing purposes. For instance, high - potency crystalline vitamin A acetate and palmitate, as well as a comprehensive range of oily dilutions and free-flowing dry powders, are now being prepared.

In so far as pharmaceutical preparations are concerned, the availability—at economically attractive prices—of high-potency concentrates of both synthetic vitamin A acetate and palmitate has greatly simplified the manufacture of more stable, convenient and pharmaceutically elegant preparations. Also synthetic vitamin A concentrates are becoming increasingly important for the fortification of foods, beverages and dietary supplements.

In recent years a great deal of attention has been paid to the role of vitamin A in the field of animal nutrition as



Automatic process control is used with the large-scale Grignard reaction.

well as to ensuring that livestock obtain adequate amounts of this essential nutrient. With the introduction of high-potency vitamin A concentrates, the problem of producing preparations to facilitate the vitamin A standardisation of animal feeds has led to the marketing of free-flowing premix powders. The Roche powders consist of finely dispersed synthetic vitamin A in a gelatin/sugar/starch beadlet which protects the vitamin A from oxidation, the adverse effect of moisture and minerals, whilst at the same time maintaining full biological activity and availability to the animal.

Harwell's new atom separator operating

Hermes, a new machine which can separate groups of slightly different atoms from the mixture of twin-like atoms (or isotopes) of which a single element is usually formed, has begun to operate at Harwell. Its name is derived from the full title of heavy element and radioactive material electromagnetic separator.

Groups of atoms which are chemically identical are separated from one another in the machine by accelerating a beam of electrically charged atoms through regions where electrical and magnetic forces cause groups of them differing slightly in weight to follow different paths through the machine.

There are two other electromagnetic separators at Harwell. The purpose of *Hermes* is to give separate radioactive isotopes. The machine and its ancillary equipment is consequently specially designed to handle highly toxic and radioactive materials. It is the largest and most complex machine in Western Europe yet built into a sealed space. In effect, it is enclosed in a glove box (a device in which poisonous and radioactive materials can be handled in complete safety, already used widely in atomic energy work). Servicing and maintenance of the machine is carried out by skilled 'frogmen' in heavy rubber suits, who enter through a corridor. The sealed building in which the separator is enclosed is 21 ft. × 25 ft. and 14 ft. high. The machine is operated from a nearby control room.

Investigation of the fundamental nuclear properties of separated radioactive isotopes is of great importance, not only in extending our knowledge of nuclear physics, but also in providing data often vital for the development of advanced reactor technology. *Hermes* will be used, for example, to assist the precise measurement of the nuclear properties of the various types of plutonium which may be generated in a nuclear reactor. It is capable of separating isotopes of plutonium in milligram range quantities, and may be used to separate radioactive isotopes of other elements.

The new machine was designed and constructed at the Atomic Energy Research Establishment. Among the principal contractors were Honeywell-Brown Ltd. (temperature regulating equipment), The Pyrene Co. Ltd. (CO_2 installation), W. G. Pye & Co. Ltd. (closed loop television), and Matthew Hall & Co. Ltd. (erection of water plant).

To Authors of Technical Articles and Books

The Editor welcomes practical articles and notes on chemical engineering and related subjects with a view to publication. A preliminary synopsis outlining the subject should be sent to The Editor, CHEMICAL & PROCESS ENGINEERING, Stratford House, 9 Eden Street, London, N.W.1.

In addition, the Publishers and Editors of the Leonard Hill Technical Group are always ready to consider technical and scientific manuscripts with a view to publication. Correspondence should be addressed in the first instance to the Book Production Manager, at the above address.

SAFETY VALVES in the Chemical Industry

By A. E. Williams, Ph.D., F.C.S.

AS its name implies, a safety valve is a device to maintain safe conditions whenever plant is operated under pressure. It usually does this by opening at a predetermined pressure and thus the pressure within the system cannot build up higher than the required limit. Variations of the safety valve include relief and back-pressure valves. A relief valve may be used on the discharge side of a pumping system, so that the pressure of the material being supplied by the pump shall not rise above a predetermined amount. Back-pressure valves are often used on exhaust steam lines, condensers, etc., to prevent damage to the system through abnormal pressure conditions. A reducing valve is also a form of safety valve, for its task is to accept material at a given pressure and to feed it out at a considerably lower pressure without allowing high pressure to get into the low-pressure side. Apart from controlling pressure in these various ways, it is often of equal importance to control temperature, particularly in process work, and this may be done by the use of magnetic valves.

Types of safety valve

There are two basic types of safety valve, the weighted-lever type, and those operated by spring pressure. Those used on boilers, autoclaves etc. may be of the low-lift or high-lift type, giving a valve rise of about 0.06 in. and 0.14 in., respectively. Generally speaking, the low-lift variety has the advantage of relieving the excess pressure gradually and is suitable for the smaller type of pressure vessel in which no great pressure develops rapidly. For larger types of pressure vessel, particularly where the internal pressure may tend to rise quickly, the high-lift valve is often preferred, for this has a much greater relieving capacity.

Earlier types of the high-lift valve often caused excessive wear on the valve seat, caused by the slamming of the valve on the seat after release of excess pressure. Modifications in design, however, have overcome this defect to a great extent, while materials used in the construction of the valves are generally chosen to give good resistance to corrosion when in contact with the gas, vapour or liquid that may be discharged through the valve.

An extra measure of safety is now sometimes applied by the use of the so-called double safety valve, which is actually two safety valves mounted on one base, and may be of the spring or lever-and-weight type. With the double-type valve each valve can operate independently of the other and so provide an extra margin of safety should one of the valves become defective or clogged. Some of the spring safety valves make use of an 'easing lever,' which when operated compresses the springs and so causes the valve to blow at a lower pressure than normal. Such a lever is commonly employed for testing the freedom of the valves on their seats, and also in case of emergency. It is obvious that no valves or cocks should be fitted between the vessel and the safety valve, since the inadvertent closing of the valve or cock would render the safety valve useless. Similarly, it is not customary to obstruct the discharge outlet of a safety valve by connecting the discharge side to a pipe system, for any stoppage in the latter would likewise prevent the functioning of the safety valve.

Applications

The rating of a safety valve is commonly based upon its performance when operating on a steam boiler and the following formula may be applied:

$$A = 0.2074 \left(\frac{W}{P}\right)$$

where A = safety valve disc area, in sq. in., per sq. ft. of boiler grate area; W = lb. of steam per hour produced per sq. ft. of grate area; P = absolute pressure, in p.s.i., of steam leaving the boiler.

While safety valves were, originally, usually associated with steam generation, they now handle a great variety of materials which are processed or stored under pressure, including water, air, natural gas, and a wide variety of vapours and liquids. They may be used at the highest temperatures and pressures, under the most severe corrosive conditions, such as on stills, reaction chambers, distillation columns, heat exchangers, accumulators, process pressure lines, compressors, pumps etc. The modern safety valve will operate at the exact pressure for which it is set, but has a minimum blow-down to prevent waste of product after over-pressure has been relieved.

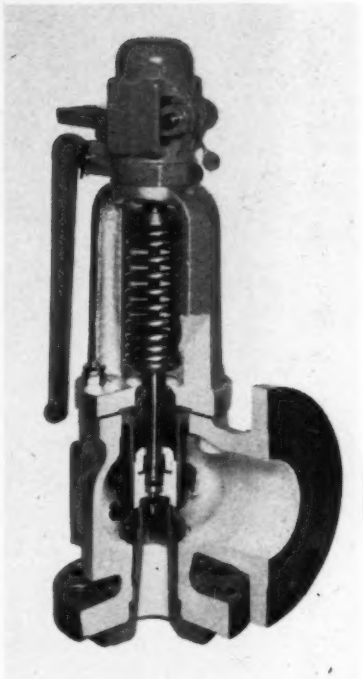
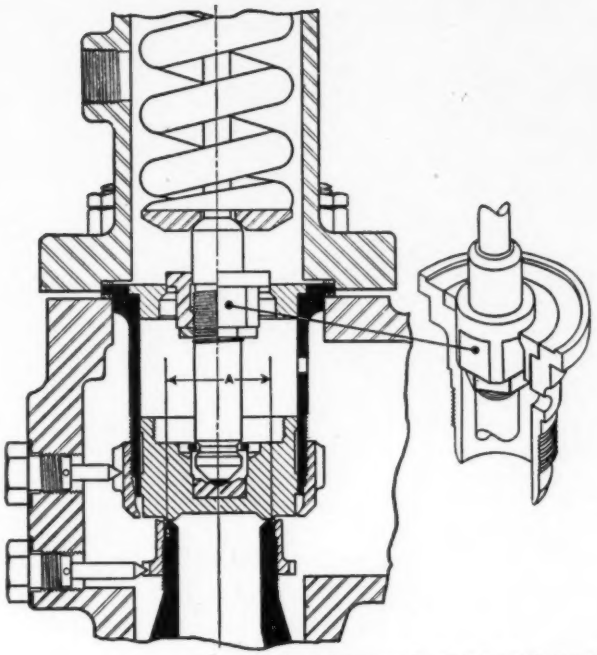


Fig. 1. A typical example of a safety valve as used on steam boilers and other pressure vessels.

Operating principles

A typical example of a safety valve is seen in Fig. 1, which depicts a nozzle-type unit having an initial opening similar to that of the older-type valves—a smooth lift of the disc to a moderate height. After the initial lift, the reaction effect of the escaping product is put to work; the product strikes the adjusting ring and changes direction. The resulting reactive force pushes the disc up, which rises to a high lift, permitting the nozzle to discharge 97% of the theoretical capacity of the same nozzle blowing free into the atmosphere. Such a design employs the reaction of the escaping product and it is this



[*Figs 1 and 2, courtesy: Crosby Valve & Engineering Co. Ltd.*

Fig. 2. A portion of the interior mechanism of a safety valve, showing piston affixed to the spindle for the elimination of back pressure effects.

reaction effect principle that is responsible for the relatively large capacity, precise control and low blow-down of the unit. The valve opens to, and closes from, a moderate lift, the high capacity being produced from a secondary, progressively increasing, lift which is distinct from the initial opening. After the valve has been popped to a moderate lift, a slight accumulation of pressure lifts the disc higher. This movement progressively exposes an upper adjusting ring which deflects the escaping product downward. The action of the deflected product is to push up against the underside of the disc and so raise it still higher. In this way the valve attains a lift equal to, or greater than, the full-bore lift within an accumulation of 3% of the set pressure.

Eliminating the distortion hazard

Safety and relief valves present a problem which is not present in an ordinary valve which is closed by screw pressure, for in the latter the disc is forced tight by the screw spindle, and the seat and disc are compelled to conform to each other if there is distortion. In the safety or relief valve, however, the disc rests upon the seat practically in a state of balance, and any distortion or inequality of surface will cause a slight leak which may become quite an appreciable leak in course of time due to the cutting action of the product under pressure.

Thermal distortion occurs because the body of a side-outlet safety or relief valve is necessarily unsymmetrical and will not expand evenly when heated. Furthermore, the body of the valve is subject to unequal stresses because the pressure and heat of the product are normally applied to only one side of the disc. In addition to these thermal distortions, there are mechanical distortions caused by the bolting of the valve body to the vessel connection.

In the older types of valves, both kinds of distortion are transmitted directly to the seating surfaces and, in these valves, leakage was difficult to prevent, particularly in valves operating at high pressures and temperatures. The design of the newer safety and relief valves, however, prevents the transmission of distortion from the body to the seat; the heart of the modern valve is the nozzle-and-disc assembly, both these components being independent of the valve body. The thread clearance between body and nozzle is such that the nozzle is allowed to expand freely without being influenced by ordinary body distortion. In full-nozzle-type valves, the joint between the vessel and valve is made directly between the vessel outlet and the nozzle itself; no screw threads are called upon to stay tight against pressure.

The nozzles are truncated cones in shape, giving maximum strength, while they are symmetrical so as to expand without distortion when hot; thus there is no wear or cutting by unequal expansion. The seating surfaces of nozzle and disc are lapped dead flat, mirror finished, so creating a perfect seat which remains tight under normal conditions. An advantage of the flat-lapped seat is the simplicity of resurfacing the faces after overhaul, for the lapping can easily be effected and seats made perfectly tight without the use of machine tools or special fixtures.

Disc guide innovation

A frequent cause of faulty operation is eliminated in the newer designs by the use of a disc guide which is entirely removed from the nozzle, whereas the feather guides below the disc in the older-type valves are in direct contact with the product. Owing to the necessarily close fit, they sometimes stick, either from expansion when hot, or from scale and deposits from the product. Bottom guides also tend to obstruct flow and cause eddy currents which reduce the capacity of the valve and cut the seating surfaces. In the modern valve the guiding arrangements are fitted above the disc and the vertical guiding surfaces are in close contact at all times during operation of the valve. Being symmetrical, the guides are free from temperature distortion and, in common with the nozzle and disc, they are independent of the valve body and so are free from outside distortion. Such a guide design provides accurate control of the disc movement: it encloses and shields the top of the disc from the influence of the discharging product and so maintains efficient functioning of the valve. Contact between spindle and disc is made by means of a hardened-steel ball embedded in the spindle and bearing on a hardened-steel cup bushing in the disc, the latter being free to seat accurately on the nozzle. Such an arrangement gives positive centering of the spindle, unaffected by any spring deflection, and avoids obstructing the throat with a depressed spindle well. This construction eliminates wear between seat and nozzle.

Back pressure

When a standard relief valve on gas or vapour service is installed under conditions where back pressure exists,

one of two undesirable effects will occur. Where the back pressure is a constant pressure, part of the back pressure acting on the upper and lower surfaces of the valve disc will balance each other or cancel out. There remains, however, a force acting on a certain area within the valve, depicted at 'A,' Fig. 2, which aids the spring and causes the valve to 'pop' at a higher pressure than that for which it is set. This may be compensated for by reducing spring compression. More commonly, however, back pressure is not of a fixed value which can be compensated for by simple spring adjustment, but will generally vary over a wide range. In the case of several valves fitted into a common discharge header, any one or more, while blowing, will produce a back-pressure surge at the closed valves of unpredictable degree. This may create a very hazardous condition, because other valves may then be prevented from opening until pressures in their containing vessels have risen far above safe levels.

These dangers are eliminated by a modified form of valve design, and stable opening pressure is achieved by the addition of a piston affixed to the spindle, of area proportioned to equal the unbalanced area of the disc. Any back pressure introduced through the port in the guide then acts on two equal areas in opposite directions, and cancels itself out, neither aiding nor opposing the spring. To assure full lift so that the nozzle throat remains the governing area, a venting system operated like a valve is employed. By matching the flow through this valve to the total flow into the guide chamber, a correct pressure balance is obtained so that the relief valve may be adjusted in the normal manner to provide satisfactory operating characteristics. The actual flow into the bonnet is comparatively low and is vented to atmosphere, or through a pipeline of appropriate dimensions to a container at approximately atmospheric pressure.

Magnetic valves

The use of magnetic valves and ancillary equipment is of value in any application where the control of either liquids or gases is required and, in addition to eliminating the variability of the human element and providing a relatively simple means of control, such valves tend to make for economy in process work by protecting the plant and product as well as reducing labour costs. In recent years the range of magnetic valves has been considerably extended and now comprises equipment suitable for the control of low-, medium- and high-pressure hot water, saturated steam, most gases, including compressed air, all liquids, refrigerants etc.

Fig. 3. An example of a magnetic valve for temperature control of processes.

Normally constructed in gunmetal for operating pressures between 5 and 100 p.s.i., they are also constructed in other metals such as cast iron and stainless steel to withstand the action of some acids, alkalis and other chemicals, and for operating pressures of 200 to 250 p.s.i. In special instances this type of valve is made for operation against a pressure as high as 1,200 p.s.i.

For normal control of liquids, gases or steam, with temperatures not exceeding 300°F., the valves comprise a gunmetal body fitted with screwed female connections or flanges faced and drilled to recommended B.S. tables. A solenoid action is fitted with suitable valve head and seating according to the product to be controlled, *viz.* mushroom for water and steam, needle for refrigerants, oiled leather diaphragm for gas, rubber for compressed air, and other suitable synthetic materials for petroleum spirit and allied products. However, there is no hard and fast rule for the type of seating to be employed for a particular product and in some cases it is varied to suit the pressure of operation.

The solenoid action is also governed by the particular application, *via* or through a thermostat or control device of an electric current to an operating coil mounted as an integral part to the upper portion of the valve body. The whole is enclosed in a cast-iron case which, apart from providing protection, also completes the necessary iron circuit for the coil. The coil itself is normally wound from appropriate-gauge enamelled copper wire, to dimensions in accordance with the pull or lift required and the length of stroke. These operating coils are finished either as 'former wound' for low operating temperatures, or 'spool wound' and impregnated for operating on higher ambient temperatures up to 300°F. Where the temperatures to be encountered are above 300°F., the coils are usually wound with glass-insulated wire. While magnetic valves may be operated from alternating current when necessary, they are generally noisy in operation, so that the use of rectifiers is usual to provide direct current. This is commonly either 80 or 160 v., according to the size of the operating coil and whether the a.c. supply available is single- or three-phase. While small types of magnetic valves can be operated fairly successfully on a.c., with the larger-type coils a.c. presents certain difficulties in obtaining the necessary 'pull' in economic sizes, and the suppression of 'hum' arising from the periodicity of the current.

Temperature control

While with saturated steam, control of pressure also controls temperature, since a given pressure corresponds to a specific temperature, with superheated steam pressure is no criterion of temperature. For this reason, in many types of process work steam can be saved by controlling temperature rather than pressure, and one method of doing this is to insert magnetic valves in the pipelines to be controlled.

An example of a magnetic cut-out valve is seen in Fig. 3, in which unit a solenoid action is provided with an appropriate valve head and seating. The action of the valve can be controlled in a variety of ways, but generally these comprise either space- or immersion-type thermostats, hand switches, interrupters or process timers; these may be arranged to control the valve direct or through relays. The function of the valve when used for temperature control is to regulate steam flow to maintain a predetermined temperature in a vessel or other required point, the flow of steam being cut off immediately the electrical circuit in the unit is interrupted. On the restoration of the current the valve will remain closed until it is manually opened by the lifting of the hand lever, as the sole-

noid is not sufficiently powerful to lift the valve head off its seating. It will then be electrically maintained in the open position until the circuit is again interrupted. After the hand lever has lifted the plunger into the magnetic field it returns to the normal position and therefore does not interfere in any way with the closing of the valve. Both for the control of processes and the heating of buildings where temperature control within fine limits is required, together with maximum steam economy, the magnetic valve is specially suitable.

In the construction of a magnetic valve, the method of assembly permits ready access to all parts, and leakage risks are obviated by the elimination of glands and stuffing boxes. Where it is required to limit the amount of closing, a hand regulating feature may be fitted, consisting of a *Lockshield* device located at the base of the valve body. This can also be utilised to open a valve of the electrically opening type in an emergency, such as current failure etc. or, conversely, for the electrically closing type. The magnetic cut-out valve may, of course, be applied to a great variety of products flowing through pipelines, and it has proved very successful for the safety control of gas- or oil-fired plant.

Controlling highly inflammable liquids

Variations of the magnetic valve are in use for the control of highly inflammable liquids. Fig. 4 depicts a typical example of a single-beat stop-pattern magnetic valve, fitted with Buxton certified flameproof coil housing. This particular type of valve has been used in considerable quantities in connection with jettisoning of supplies of high-octane spirit contained in high-level fuel storage tanks. The single-beat stop valve is also designed to control the flow of water, refrigerants, gas and air, as well as all types of oils. It is commonly provided with a reduced orifice, enabling operation at pressures up to 100 p.s.i. With larger orifices, of course, this differential pressure is reduced, but the volume handled is increased.

The so-called high-pressure magnetic stop valve is a shut-off pattern and is suitable for handling water, saturated steam, oils and gases at pressures up to 100 p.s.i. and, when fitted with a suitable operating coil, will handle saturated steam and high-pressure hot water at much greater pressures. In this type of valve the solenoid operates a small pilot valve only, controlling the flow to the main valve, which latter is opened by the pressure of the product under control. For positive operation it is necessary for a pressure drop of at least 15 p.s.i. to be maintained across the valve. These valves have what is termed a 'snap' action when in operation and it is sometimes necessary to install a suitable air vessel on the inlet side to overcome the possibility of liquid hammer.

Fine temperature control

Where temperature control is required to very fine limits, use may be made of the single- or double-port magnetic balanced regulating valve.

In the single-port unit the construction is such that the pressure is balanced on both sides of the double-mushroom-type valve head. This is a throttle-type valve, allowing a small leak when in the closed position. Such a small leak is in most cases advantageous and often produces finer temperature control than is possible with a completely shut off valve, especially in heating installations.

[*Figs. 3 and 4, courtesy: Magnetic Valve Co. Ltd.*

Fig. 4. Single beat stop valve of the magnetic type for the control of inflammable liquids.

For closer temperature control than can be obtained with the single-port unit, a double-port unit of the same type may be employed. This has two separate valves of different dimension orifices in one body, the combined area of which equal the total orifice required. Each valve is operated by a separate coil, so by using a controlling thermostat of the double-contact type with a back contact on one head, three degrees of opening and closing can be obtained; for example, both ports may be open together, or the smaller and larger may be open separately and, of course, alternatively, closed.

Magnetic valves of various types have become popular in refrigeration plants for the control of cold water, sodium and calcium chlorides, methyl chloride, *Freon*, ammonia etc. They control the conveying and burning operations on oil and gas installations by regulating flow according to temperature required. In compressed-air installations they are used for pneumatic control and unloading features of air compressors, cylinders and receivers.

For the pasteurising of sensitive products such as beer and milk they are in use to give accurate temperature control. For the general control of industrial processes in which temperature control within fine limits is required, the magnetic valve is particularly applicable.

Letter to the Editor

DEAR SIR,

In view of the information regarding valve control by temperature difference on page 2 of your January 1957 issue, we feel that you may be interested to know that one of the large British chemical companies has been controlling processes by a similar temperature difference method based on the use of resistance thermometers for some six or seven years. Moreover, the temperature difference range is nothing like as large as that mentioned in the American system, the full-scale range of the instrument being in fact 2°C., and the normal working difference in temperature to initiate control action being 1.5°C.

These particular controllers incorporate self-balancing Wheatstone Bridge instruments of our manufacture, incorporating conventional proportional plus integral pneumatic controls.

Yours very truly,
E. S. MILK,
Manager, General Sales Office,
Honeywell-Brown Ltd.,
1 *Wadsworth Road,*
Perivale,
Greenford, Middlesex.

Transient Behaviour of Distillation Columns

INVESTIGATIONS into the dynamic characteristics of a distillation column described in one paper were linked with the development of a programme for an electronic digital computer, discussed in another, at a meeting of the Institution of Chemical Engineers in London recently. By means of the programme the equations governing mass-transfer in a distillation column can be solved quickly and easily, and the work on this subject was started independently of the experiments described in the other paper. The two papers were brought together to give a comparison between theory and experiment.

The scope of the investigation by W. D. Armstrong, M.A., PH.D., and W. L. Wilkinson, M.A., was to study the unit process of binary distillation in a plate tower. The apparatus used was a 4-in. 21-plate distillation column, whose dynamic characteristics were examined experimentally using a mixture of benzene and carbon tetrachloride.

The object of the control system in a continuously operating fractional distillation unit is to maintain a predetermined state of dynamic equilibrium despite the disturbances which may occur either in the flow, composition or enthalpy of the material streams entering the plant or in the heat flows to the reboiler or condenser.

The current practice is to control at a constant value all the conditions which can be controlled, and which affect the process, except one. This is then used as the corrective medium by the main controller whose function it is to maintain the most important condition of the plant at a desired value despite uncontrolled disturbances or non-ideal performance of the subsidiary controllers.

The fundamental data required for the process are the dynamic relations between (*a*) the disturbance and the controlled variable and (*b*) the control action and the controlled variable. Many combinations of variables are possible, but in this paper the system most commonly encountered in industrial practice was considered. In this the most important 'condition' to be controlled is plate concentration and the main controller employs the reflux return rate as corrective medium. The external disturbance considered was feed composition.

A number of equations was evolved to express the results of these experiments from the points of view of response to feed composition disturbances, response to step change in reflux return rate and determination of operating hold-up.

Results of experiments

The response of plate composition is of the form expected, the response being slower the further the plate from the point of the disturbance.

A step disturbance in reflux ratio produced a response which was considerably faster than the former and less dependent on distance from the point of disturbance. In changes of this sort involving a sudden change of the flow conditions the fluid dynamic effects in the column would be an important factor and this could account for marked differences.

The general conclusions drawn are that the time scales involved in the transient response of plate-type distillation columns following a disturbance are much larger than in many process control systems and consequently the control characteristics may be expected to be poor.

Theoretical work

The experimental time-composition curves of Armstrong and Wilkinson were found to conform to the digital computer solutions of H. H. Rosenbrock, B.SC.(ENG.), PH.D., A.M.I.E.E., who presented a detailed statement of the equations which govern the transient behaviour of plate-type distillation columns, together with a discussion of the available methods of solution. From his study it emerges that the use of digital computer methods is invaluable for a rapid and accurate solution of the equations in their general form.

In addition to the comparison presented by Armstrong and Wilkinson, the programme has been used for studying the design of columns for producing heavy water. It has been found that a chemical engineer can produce rapid and economical answers by a process of trial and error. The product flows, number of plates, feed position etc. are chosen at what seem appropriate values and the machine gives the equilibrium condition in a few minutes. Improvements can then be made to the first assumptions and new equilibrium values found.

RECENT PUBLICATIONS

Tar works. The new tar works of the N.C.B. at Wingerworth is the subject of a brochure published by Chemical Engineering Wiltons Ltd., Bird Hall Lane, Cheadle Heath, Stockport, who designed, built and commissioned the plant. Photographs and explanatory diagrams illustrate the descriptions of the distillation unit, the naphthalene unit and the units for the extraction of tar acids and tar bases.

Surface - active chemicals. Marchon Products Ltd., Whitehaven, Cumberland, have issued a booklet detailing the application of their range of synthetic surface active agents to a wide number of industries. An alphabetical list of their *Empicols*, *Empilans* and other products is appended.

Brine testing books. The testing of brine *p*H is reduced to the simplest possible procedure with the brine testing books introduced by the A.P.V. Co. Ltd., Manor Royal, Crawley, Sussex. Each book, which is waistcoat pocket size (2 × 3½ in.), contains three polythene-wrapped booklets of papers, covering *p*H ranges 5.2 to 6.7, 6.8 to 8.3 and 8.4 to 10. Colour reference charts within booklet covers make the reading of *p*H values a simple and accurate task. Each brine testing book is good for at least 20 tests and cost 2s. 6d.

Titanium. Published by Titanium Metal Alloys Ltd., 2 Metal Exchange Buildings, Leadenhall Avenue, London, E.C.3, a new brochure gives useful specifications of the properties of 'commercially pure' titanium and of titanium alloys. The weldability of titanium is discussed briefly and a table showing the behaviour of the metal in contact with various corrosive media is included. The brochure concludes with a short description of the range of work carried out with titanium by the company in its Sheffield works.

Air filtration. The Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London, E.C.4, has recently brought out the third edition of an illustrated 40-page booklet on the *Preciptron* electrostatic air filter. As well as reviewing the use of the system in combating atmospheric pollution, the removal of liquid droplets in the air by *Preciptron* oil mist filter units is described.

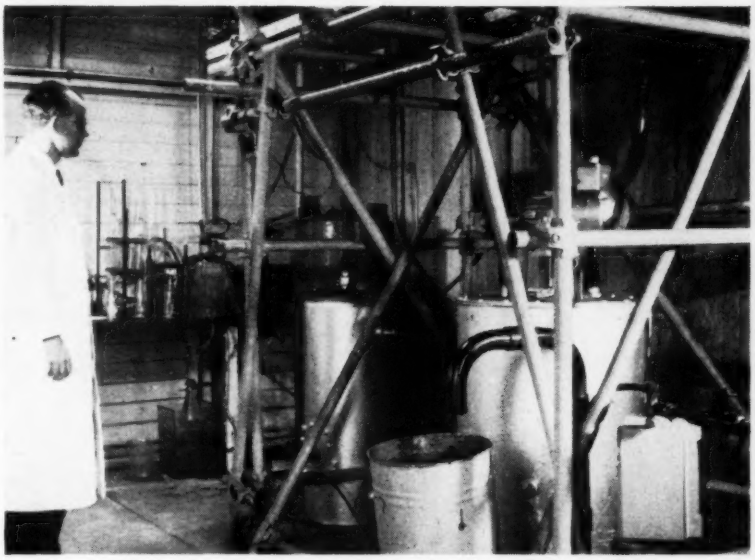
SULPHUR FROM SEWAGE SLUDGE

By John Grindrod

Why should the sulphur from sewage sludge go to waste? High hopes are pinned on experiments now being carried out in Britain which, if they can be put into effect on a commercial scale, could make a valuable contribution to supplies of sulphur.

EXPERIMENTS with a view to the production of sulphur from sewage sludge by an industrial microbiological process have recently been carried out at the Chemical Research Laboratory of the Department of Scientific and Industrial Research, Teddington, Middlesex, which, in view of the large-scale use of sulphur in industry and its recurring shortages, might have considerable significance for sulphur users.

Attention has been drawn by a number of authorities to the possible use of bacteria to produce sulphide or sulphur from the plentiful supplies of sulphate in Britain. For instance, the transformations of sulphur compounds in nature is an application of the same process which has been occurring for millions of years, while a much more recent example has been demonstrated by the action of sulphate-reducing bacteria, which caused the grounding of aircraft in Egypt and Malaya through corrosion of their fuel pumps, the hydrogen sulphide produced by these organisms percolating through the fuel and forming corrosive sulphur compounds.



Pilot plant at L.C.C. Northern Outfall works, Beckton.

Sulphur-producing lakes

Many instances could be cited of the way in which sulphate-reducing bacteria work in nature where the chief raw materials—sulphates, reducing agents and nutrients for the growth of bacteria—are present in sufficient quantities. One particular site where this process is occurring naturally and continuously on a large scale is in sulphur-producing lakes in the desert in Cyrenaica, about 20 miles south-west of El Agheila.

In 1950, two members of the Microbiology Group of the Chemical Research Laboratory, Mr. K. R. Butlin and Dr. Postgate, organised an expedition into the Cyrenaican desert to examine these lakes in which some hundreds of tons of elemental sulphur were being produced annually. They found that the sulphur was being formed by the combined action of sulphate-reducing bacteria, which produced sulphide from dissolved gypsum and photosynthetic sulphide-oxidising bacteria (*Chlorobium* and *Chromatium*), which, in bright sunlight, converted the sulphide into elemental sulphur.

Fuel pump failure caused by sulphur formation

With regard to the more recent phenomena of petrol-driven and jet aeroplanes being grounded because their fuel pumps were heavily corroded, several instances have occurred during the past few years. All the failures occurred in hot climates, *e.g.* in the Middle East and in Malaya, and, so far as is known, there have been no failures in cooler climates.

For example, serious trouble was experienced with the seizing of petrol pumps of piston-driven aeroplanes in Egypt. On stripping, the pumps were found to be choked with a deposit of copper sulphide. The corrosive aviation spirit causing this deposit was traced to a storage tank in which the petrol was stored over water which had been stagnant for about six months. Samples from this tank were examined at the Chemical Research Laboratory and were found to be heavily infected with sulphate-reducing bacteria and to contain large quantities of ferrous sulphide. There have been other serious cases of deterioration of aviation petrol in similar circumstances in Egypt, North Africa and Malaya. Contamination of kerosene stored over sea water at Bagan Dalan, Malaya, caused the grounding of military jet planes, the microscopic bacteria having turned the sulphate in sea water into hydrogen sulphide, which reacted later with silver in the fuel pump system.

It is this same type of bacteria which scientists of the Chemical Research Laboratory at Teddington recently announced they were now experimentally, but successfully, using to produce sulphur from London sewage sludge, and they hope to be able to manufacture sulphur on an industrial scale by this method.

Sulphur-from-sludge process

The method is based on the semi-continuous anaerobic (oxygen-free) digestion of raw sludge employed in many sewage works. Normal digestion at about 30°C. produces a gas mixture containing approximately 70%

methane and 30% carbon dioxide. When sulphate in the form of gypsum, anhydrite, or waste sulphate from fertiliser manufacture is added, methane production is inhibited by the hydrogen sulphide produced by the sulphate-reducing bacteria. In the Chemical Research Laboratory process the H_2S is swept out by the methane/carbon dioxide gas mixture produced from a normal digestion. The final gas mixture of H_2S, methane and CO_2 should contain at least 5% H_2S for economical recovery of sulphur. Yields of 1 to 1.5% H_2S/sludge used have been obtained in the laboratory.

Thames pilot plant work

Pilot-plant (50-gal.) trials are being conducted at the Northern Outfall Sewage Works, Beckton, in collaboration with and by courtesy of the London County Council authorities. Results equal to those obtained in the laboratory experiments at Teddington have already been obtained and trials on a much larger scale (100,000 gal.) are contemplated.

At present some 4,000 tons of sludge are sent in barges daily down the River Thames to the sea from the Beckton sewage plant alone and it is thought feasible that this could produce at least 40 tons of sulphur daily. Furthermore, the treatment with bacteria reduces the amount of material at present necessary to deposit in the sea.

Discoveries about sulphur in sludge

The changes that occur during sulphate reduction in sulphated raw sludge are thought to be similar to those which occur during the anaerobic digestion of raw sludge to produce CH_4 and CO_2, when the more complex constituents—cellulose, proteins, fats, etc.—are broken down by a variety of micro-organisms to simple compounds, particularly fatty acids and ethyl alcohol, which are then utilised by the methane-producing bacteria. This is considered so because pure cultures of laboratory strains of *Desulphovibrio desulphuricans* inoculated into sterile raw sludge produced negligible sulphide. Only when mixed populations of sulphate-reducing bacteria and other micro-organisms derived from digesting sludge were used did considerable sulphate reduction occur.

Practical considerations

Since, at many modern sewage works, the production of methane from anaerobic digestion is economically essential for the operation of the plant, sulphide production, to be economically useful, must not interfere unduly with methane production. It is considered by K. R. Butlin, Sylvia C. Selwyn and D. S. Wakerley, in their detailed paper on the C.R.L. experiments (*J. Appl. Bacteriology*, June 1956, **19** (1)) that, ideally, this condition would be best fulfilled if the two processes could be carried out together in the same fermenter by the semi-continuous method used at some sewage works for methane production, the methane serving to sweep the H_2S out of solution. At present this is considered impossible because methane production is almost completely inhibited and little sulphide is obtained, since the H_2S remains in solution and retards further sulphide production. It was thought possible, however, that with the development of strains of methane-producing bacteria resistant to sulphide a balance between the two processes could be established, *e.g.* by limiting the amount of sulphate available for reduction. Some progress has been made with the development of resistant strains.

Subsequent work shows that, though the simultaneous production of methane and hydrogen sulphide is feasible, it may not be worth while. For economic working, sludge should be digested to produce either methane or sulphide.

Gas in Industrial Processes

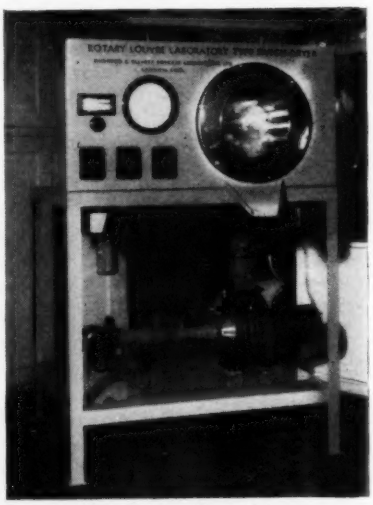
The great diversity of uses of gas in industrial processes was well illustrated in an exhibition held in London recently, at which exhibits ranged from gas-fired water and space heaters to equipment for shell moulding, tool cutting and flame hardening.

On a stand devoted to various methods of heating liquids, Nordac Ltd., with their submerged combustion unit, offered a particular attraction to chemical engineers. The industrial applications of submerged combustion include the heating, evaporating and concentrating of such liquors as spent pickle, process sulphuric acid, sodium phosphate and phosphoric acid. The advantages of this method of heating are that there are no heat transfer surfaces, negligible radiation losses and very low consumption of fuel, gas or oil.

Many of the units displayed were electronically controlled and a wide range of instruments was shown. Instruments for temperature recording, control of gas-fired heat-treatment furnaces and flame safeguard equipment for industrial heating ovens were shown by Honeywell-Brown Ltd. These included the *Electron K* pneumatic controller, for the continuous control of temperature, the multi-point *ElectroniK* recorder, for the measuring of six different furnace temperatures or six different levels of temperature in one furnace, and the *Protectoglo* combustion safeguard unit, safeguarding against possible explosion hazards.

On a special stand devoted to metal melting appliances, an interesting exhibit was the latest improved model in the range of crucible furnaces supplied by Morgan Crucible Co. Ltd.—a special-purpose unit for direct pouring, billet, strip, sand casting or the many melting shop processes now in vogue. Another interesting unit was shown working with a cold-chamber die-casting machine.

In the field of radiant heating, a laboratory-type batch drier shown by Dunford & Elliott Process Engineering Ltd. demonstrated rotary louvre operation. This principle is used in continuous units ranging in size up to 10 ft. 3 in. diameter × 42 ft. long.



Dunford & Elliott drier.

Chemical Plant Construction Costs Still Rising

WHEN we introduced the CHEMICAL & PROCESS ENGINEERING chemical plant construction cost index in January, we showed the rise of British chemical plant costs in the past few years and last month we made some comparison between British and American cost increases. Now, with the figure for December available, we are able to print the accompanying tables giving the complete index for 1956 and the annual averages from 1945 to 1956, inclusive.

Chemical plant construction cost index for 1956 (*June* 1949 = 100)		*Annual averages*, 1945-56 (*June* 1949 = 100)	
January	164.4	1945	76.8
February	164.4	1946	84.2
March	166.5	1947	94.0
April	165.9	1948	98.3
May	166.1	1949	101.2
June	164.9	1950	110.6
July	164.9	1951	129.5
August	165.3	1952	141.9
September	165.8	1953	139.4
October	166.3	1954	143.6
November	166.8	1955	157.4
December	168.4	1956	165.8

Technology Notebook

Research — Education — Discussion

British Nuclear Energy Conference expansion

At a meeting of the British Nuclear Energy Conference, under the chairmanship of Sir John Cockcroft, O.M., K.C.B., F.R.S., it was decided to admit to membership the Iron and Steel Institute and the Institute of Metals.

The original constituent members of the B.N.E.C. were the Institutions of Civil, Mechanical and Electrical Engineers, the Institute of Physics and the Institution of Chemical Engineers.

Scaling-up chemical plant and processes

A joint symposium of British and Dutch chemical engineers will be held at Church House, Westminster, London, S.W.1, on May 28 and 29, to discuss the scaling-up of chemical plant and processes. It is expected that this conference will contribute considerably to the knowledge required by all practising chemical engineers of how to develop the process handed to them by their chemical colleagues into a large-scale process as cheaply and as fast as possible.

The organising bodies are the Chemical Engineering Group of the Society of Chemical Industry, the Institution of Chemical Engineers, Het Koninklijk Instituut van Ingenieurs and De Koninklijke Nederlandse Chemische Vereniging.

Steel coatings and surface preparation

The British Iron and Steel Research Association will hold two ' open days ' at the Sketty Hall, Swansea, laboratories on June 20 and 21, 1957, for representatives of B.I.S.R.A. member firms and users of steel sheet and strip throughout industry.

The Sketty Hall laboratories are devoted to research into problems concerning steel coatings and methods of surface preparation. Demonstrations will be given on the recently installed experimental line for the production of PVC-bonded steel strip, and on the differential roller tinning pilot plant now being built. Other projects, including the continuous lacquering of steel strip, the use of iron-zinc and iron-tin alloys, and research into methods of gaseous deposition of metallic coatings, will also be displayed and demonstrated.

Teaching safety methods

The Birmingham and District Industrial Safety Group report the successful conclusion of the first course for chemical workers at their industrial safety training centre in Birmingham. It was well attended by representatives of companies from all parts of the country. The subjects dealt with included the handling of chemicals, inflammable materials and explosives. There were practical demonstrations and detailed instructions on the storage and marking of containers.

Other talks included the inspection of and entry into vessels, and the rules for carrying out repairs on plant and pipelines. There were practical demonstrations of first aid including the use of breathing apparatus of various types. Another session dealt with the proper use of protective clothing.

Further similar courses are planned for April 2 to 3 and November 5 to 6 this year.

New regulations for D.S.I.R. grants

The new edition of ' Notes on D.S.I.R. Grants for Graduate Students and Research Workers ' (H.M.S.O., 1s. 3d.) includes further details of the revised arrangements for post-graduate studentships in science and technology first announced early in November.

Provided sufficient candidates of a high enough standard are forthcoming, D.S.I.R. will award in 1957 about 700 research studentships (formerly known as maintenance allowances) and about 200 advanced course studentships, a new sort of award. This figure of about 900 compares with about 400 new maintenance allowances awarded annually by D.S.I.R. in recent years, plus, of course, the number (250 to 300) that will no longer be awarded by the Ministry of Education and local education authorities in England and Wales.

Chemical engineering courses and training schemes

Two useful lists have been issued by the Institution of Chemical Engineers, one giving details of courses in chemical engineering in British universities and technical colleges from full degree courses to part-time day and evening courses, and the other describing the training schemes for student apprentices in chemical engineering offered by a number of industrial concerns and official bodies such as the Ministry of Supply and the United Kingdom Atomic Energy Authority. Information is supplied about the duration, nature and location of the apprenticeship, and about the varying educational qualifications for admission.

INDUSTRY REPORTS . . .

Increased Jordanian phosphate output

The Jordanian Phosphate Co., which produced 208,557 tons of phosphate in 1956, plans to boost its output to 1 million tons by 1960, according to its annual report. In 1957, production is to be increased to 400,000 tons. Agreements have recently been concluded with Yugoslavia, Czechoslovakia and Italy for the sale to these countries of 250,000 tons this year. A company delegation will also visit Japan, India, Pakistan and Indonesia this year to negotiate further sales, the report says.

Reviewing the past year, the report gave details of a 140,927-dinar agreement with a Belgian firm for the installation of apparatus to carry phosphate from the mines to the company's factory. The scheme is to be completed during 1957.

It said that a furnace for drying phosphate with a daily production potential of 600 tons would start operating at Ruseifeh in March.

Oil and chemicals

Reviewing the world-wide operations of the Royal Dutch-Shell group of companies, Mr. J. H. Loudon, president of the Royal Dutch Co. and a managing director of the group, stated that, in the first ten months of 1956, the rate of crude oil production, including purchases of Kuwait crude and other special supply contracts, was about 10% higher than in 1955, when it averaged 1,930,000 bbl./day. Mr. Loudon pointed out that the group has a healthy and growing business in petrochemicals, gross chemical proceeds at present running at about 8% of the group's total gross proceeds.

Coke oven plant

During the past financial year the major undertaking of United Coke & Chemicals Co. Ltd. has been the continuation of the building of a battery of 43 coke ovens to replace a similar number of obsolescent ovens. These are scheduled to come into operation in July of this year. This is revealed in the statement by the chairman of the United Steel Companies Ltd., the parent company.

The nickel industry in 1956

The year 1956 was one of the most eventful in the history of the nickel industry, according to a statement made recently by Dr. John F. Thompson, chairman of the board of the International Nickel Co. of Canada Ltd. Production of nickel in the free world set a new high record in 1956 at approximately 450 million lb. Output by Canadian producers again accounted for about 80% of the free world's supply.

The year marked the beginning of the development in Manitoba by International Nickel of the world's second largest nickel production operation which will result in a substantial increase in nickel supplies by 1960. It also saw the United States Government arrange for the diversion to industry of substantially increased quantities of nickel originally scheduled for shipment to the Government stockpile.

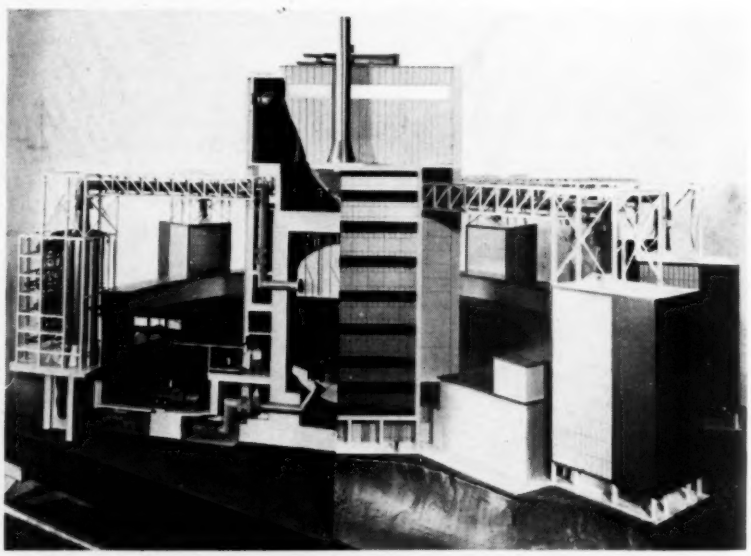
The demand for cupro-nickel alloys for heat-exchanger tubes used in the marine, petroleum and power industries continued strong. The greater requirements for cupro-nickel alloys arise from feed-water heaters and associated equipment to meet the trend of increased pressures and temperatures.

The production of *Ni-Resist* corrosion-resisting nickel cast irons increased during the year. These alloys were broadly used in the chemical process and petroleum industries and in high-powered engine service to resist corrosion, heat and wear. The output of *Ni-Hard* abrasion-resisting nickel-chromium cast irons also showed an increase over 1955. Leading applications for these cast irons were grinding balls and mill liners as used by the cement and mining industries.

Consumption of nickel as a catalyst during 1956 by the chemical and allied industries showed an increase, with consumption about three times that of five years ago.

Gas industry progress report

The main achievements of the gas industry during the seven years since its nationalisation in 1949 are summarised in a booklet issued by the Gas Council, revealing that overall production efficiency has been increased from 71 to 76% and 75.2 therms are now obtained per ton of coal carbonised as against 72.5 therms in 1948. As a result, 2 million tons of coal less are needed for today's gas production than would have been required at the efficiency level of 1948. Since vesting day £318.8 million have been invested in fixed assets and this investment has enabled the daily capacity of gas-making plant to be increased by over 20%.



NUCLEAR POWER STATION REACTOR HOUSE

A model produced by John Thompson Ltd., showing one of the reactor houses complete with heat exchange towers for the nuclear power station to be built at Berkeley, Glos., which was referred to in our February issue. The sectionalised portion shows one of the heat exchange circuits in which gas carries heat from the reactor to the heat exchange towers.

★ Personal Paragraphs ★

★ **Mr. P. Jaram** has joined Q.V.F. Ltd., suppliers of visible-flow glass pipeline for industry, as manager at their new premises in Duke Street, Fenton, Stoke-on-Trent. Mr. Jaram, who is 31, comes to Q.V.F. Ltd. from James A. Jobling & Co. Ltd., having been production control supervisor at their Pallion, Sunderland, factory, which produces visible-flow glass pipeline for Q.V.F. At Fenton, Mr. Jaram will additionally be responsible for co-ordination of supplies and for warehouse control.

★ **Mr. J. M. Storey,** managing director of Dewrance & Co. Ltd., recently spent five weeks in the U.S., renewing contact with the company's American associates to discuss technical developments in valve engineering, and also the consolidating of manufacturing arrangements under licensing agreements.

★ **The Hon. Sir Francis Hopwood,** who is a managing director of the Shell Petroleum Co. Ltd., and a principal director of N.V. De Bataafsche Petroleum Maatschappij, the two parent operating companies of the Royal Dutch/Shell group, is to retire from these offices, effective June 30, 1957, before which date he will have reached the age of 60. He will remain a managing director of The 'Shell' Transport and Trading Co. Ltd. and a director of The Shell Petroleum Co. Ltd. **Mr. H. Wilkinson,** president of Canadian Shell Ltd., has been appointed, with effect from July 1, 1957, a managing director of the Shell Petroleum Co. Ltd. and a principal director of N.V. Bataafsche Petroleum Maatschappij.

★ It has been announced that the Lord President has accepted with great regret the resignation of **Sir Hugh Beaver** from the Council for Scientific and Industrial Research. As Sir Hugh has now become deputy president of the Federation of British Industries, he has been obliged to limit his other activities in consequence. He has served on the Council (and as chairman of its predecessor, the Advisory Council) for four years.

★ **Mr. W. C. Anand,** factory manager of Kenya Sugar Ltd., Mombasa, spent three months at the end of last year visiting sugar factories and sugar machinery manufacturing works in Germany, United Kingdom and France, including those of Tate & Lyle Ltd., George Fletcher, Babcock & Wilcox Ltd., Pott Cassels & Williamson at Motherwell and A. & W. Smith of Glasgow. Braunschweigische Machinenbauanstalt arranged visits for Mr. Anand to the Sugar Institute and many sugar factories in Germany and Compagnie de Fives Lille, of Paris, gave him an opportunity to see their works.

★ **Mr. C. E. Evans,** O.B.E., previously general manager of British Hydrocarbon Chemicals Ltd. at Grangemouth, was recently appointed general manager of British Hydrocarbon Chemicals Ltd., not The Distillers Co. Ltd. as reported in our February issue.

★ **Mr. J. Eden,** until recently sales and contracts manager for Birtley Engineering Ltd., has joined Messrs. W. P. Butterfield Ltd., engineers and tank manufacturers, at Shipley, Yorks, as contracts manager.

★ **Mr. R. T. de Poix** has been elected chairman of the Zinc Development Association for 1957. Mr. de Poix is the managing director of Henry Gardner & Co. Ltd., and represents the Canadian zinc producers—the Consolidated Mining & Smelting Co. of Canada Ltd., and the Hudson Bay Mining & Smelting Co. Ltd.—on the council of the Association.

★ **Mr. F. E. Barritt,** works manager, and **Mr. L. R. Pullen,** sales manager, were recently appointed to the board of directors of K.D.G. Instruments Ltd.

★ A number of appointments have been made to the board of Imperial Chemical Industries Ltd. **Dr. R. Beeching,** who since 1955 has been chairman of the Metals Division, now becomes technical director. **Dr. J. Ferguson** becomes research director. In 1951 he became the joint managing director of the General Chemicals Division. **Mr. L. H. Williams** becomes director in charge of group B—dyestuffs and pharmaceuticals. This appointment is effective from April 1, on the retirement of **Mr. P. K. Standring. Mr. C. M. Wright** has been appointed development director. He became personnel director of the Billingham Division in 1952 and chairman of Wilton Council in 1954.

Two changes on the main board of I.C.I. have also been announced. **Mr. J. L. S. Steel** has been appointed economic planning director and **Mr. C. Paine,** previously development director, succeeds Mr. Steel as group A (heavy chemicals) director.

★ **Dr. Frederick R. Paulsen** became full-time editor of *Atomics and Nuclear Energy* (a publication of the Leonard Hill Technical Group) on January 1. Born in Brighton, his education there culminated in a B.SC. (London) in 1936, with chemistry as the main subject. Subsequently, he added a PH.D. (Sheffield) in the Faculty of Engineering, and also became a F.R.I.C. Dr. Paulsen has had a varied experience in industry, having been engaged in perfumery and cosmetics, heavy chemicals and explosives, and in atomic energy. His career has also included much educational work, for apart from being a lecturer in chemistry at Brighton, he has also been head of science departments in three large technical colleges. During his employment with the Ministry of Supply, under whose auspices atomic developments were made until the creation of the Atomic Energy Authority, he worked at Harwell on radio-chemistry, and also at the Windscale Works, at Sellafield, Cumberland, where he was in charge of a research team engaged on problems connected with plutonium, uranium and fission products. Primarily a chemist, Dr. Paulsen has wide interests, and has never specialised in a narrow field. He hopes that he will be able to be implemental in making *Atomics and Nuclear Energy*, with its 'new look,' even bigger and better.

★ **Mr. M. Jones** has been appointed development director, and **Mr. H. C. Raine** research director, of the Plastics Division of Imperial Chemical Industries Ltd.

★ **Mr. E. G. Clarke,** managing director of Acheson Colloids Ltd., has been elected to the board of directors of Acheson Industries Inc., of New York, the parent company to which the British unit of Acheson Colloids Ltd. is affiliated.

★ Armour & Co. Ltd. announce the appointment of **Mr. F. K. Johnson** to their Chemical Division, to handle the sale of cationic chemicals to the petroleum industry in the United Kingdom. Mr. Johnson was previously with the production department of the Associated Ethyl Co. Ltd.

★ **Mr. J. Platt,** hitherto head of the recovery department of the Pfizer fermentation plant at Sandwich, Kent, has been appointed production controller of the company. Pfizer Ltd. has also announced the appointment of **Mr. T. Black** as manager of commercial development.

COMPANY NEWS

The engineering division of Head Wrightson has become a wholly-owned subsidiary company of Head Wrightson & Co. Ltd. with the title of Head Wrightson Teesdale Ltd. This company will carry on the business of the engineering division with no change of personnel.

*

The Belfast Branch Office of Honeywell-Brown Ltd. has moved to much larger premises at 296 Albert Bridge Road, Belfast. The new office is fully equipped to deal with all enquiries for industrial instrumentation, heating and air conditioning controls, and precision switches.

*

Borax Consolidated Ltd., operating subsidiary of Borax (Holdings) Ltd., have recently acquired research laboratories at Tolworth, in Surrey, to provide facilities for a staff of 50 chemists or more.

*

The A.E.I.-John Thompson Nuclear Energy Co. Ltd. and the Morgan Crucible Co. Ltd. are forming a joint company, Nuclear Graphite Ltd. This company will specialise in the machining of graphite blocks for the construction of the massive graphite moderator piles in atomic reactors—similar reactors to those in use at Calder Hall.

Nuclear Graphite Ltd. will be backed by the vast engineering resources of both the A.E.I.-John Thompson Nuclear Energy group and Morgan Crucible. To this venture Morgan Crucible, with a leading position in the development of carbon and graphite materials for industry, brings extensive experience already gained in the atomic field. It is of interest to note that they have just completed the manufacture and machining of the special graphite blocks to be employed as the neutron shield for the Dounreay fast breeder atomic reactor.

*

The former Solway Flowrators Ltd has become a 100% subsidiary of the Fischer & Porter Co., of Hatboro, Pennsylvania, U.S., and is now known as Fischer & Porter Ltd. The range of equipment to be produced will be considerably extended and will include not only variable area flowmeters, but also complete process control equipment, including recorders and indicators, differential-pressure transmitters and pneumatic and electronic controllers.

British Patent Claims

Extraction or fractionation apparatus

An apparatus for contacting two immiscible or slightly miscible liquid phases of different density consisting of a high number of extraction units, the mobile liquid phase being simultaneously dispersed in the stationary phase in all the units by flowing continuously through small orifices; settling takes place at the same rate as dispersal in the same containers.—760,921, *Centre National de la Recherche Scientifique* (*France*).

Fluid-treatment apparatus

Alternate treatment cells and empty cells (*e.g.* of an ion-exchange water or gas purifier) are separated by microporous diaphragms. Treated fluid flows through the cells in series, while material flows transversely through the treatment cells only during regeneration.—761,159, *J. F. Zwicky*.

Cyclone dust separator

The inlet pipe slopes downwardly to the cyclone head, so as to direct the gas stream on its helical path, such head being of helical form to assist the action of the pipe. Separation of carbon black is mentioned.—762,070, *Jones Gas Process Co. Ltd.*

Separation of gaseous mixtures

In, *e.g.*, a hydrocarbon adsorption separation process utilising powdered fluidised solid adsorbent and comprising the steps of adsorption, rectification, desorption, adsorbent dehydration and cooling, the adsorbent is passed downwardly through a vertical section column and extracted from the bottom section. Dehydrating gas then carries it to the top of the column, for separation from such gas and refeeding to the column.—761,305, *Esso Research & Engineering Co.* (*U.S.*).

Manufacture of styrene/butadiene copolymers

Styrene and butadiene (in the form of a C_4 hydrocarbon fraction containing 10-90 wt.% butadiene) are copolymerised in aqueous emulsion in the presence of a free radical initiator to give a copolymer containing $\leq$ 40% styrene which is used as a rubber additive, paper treating agent and in the manufacture of adhesives, latex and paints.—761,133, *Petrochemicals Ltd.*

Phenol production

A benzene monocarboxylic acid, or its salt, ester or anhydride, having an unsubstituted *o*-position, while molten or dissolved in an inert solvent, is heated, in contact with a Cu compound which dissolves therein at the reaction temperature and in the presence of O_2, to a temperature at which CO_2 is evolved.—762,738, *Dow Chemical Co.* (*U.S.*).

Polymerisation process

An aqueous dispersion of a F-containing organic compound is polymerised (or copolymerised) in the presence of a $\leq C_5$ chlorofluoro-carboxylic acid (or its salt) as dispersing agent.—761,327, *Farbwerke Hoechst A. G. vorm. Meister, Lucius & Bruning* (*Germany*).

Surface-hardening of titanium

A thin layer of powdered Ni, Mn or Cr (or mixtures or alloys) is applied to the titanium and heating is effected in an atmosphere inert to titanium, to diffuse the powder, at a temperature below the M.P. of titanium and the powder. — 763,909, *General Motors Corp.* (*U.S.*).

Organic compounds of aluminium and beryllium

An Al or Be hydride (or a monovalent, saturated hydrocarbon substituted derivative thereof) is heated with a hydrocarbon mono- or polyolefin at such a temperature, *e.g.* at 30 to 120°C., if necessary under pressure, that an additional product is produced without decomposition, *etc.*; the metallic compound is added to the olefin in a proportion $\leq$ 6 mols olefin per equiv. wt. of metal. The products are used in chemical synthesis and their reaction products with $HgCl_2$ have bactericidal and fungicidal properties. — 763,824, *K. Ziegler* (*Germany*).

The above abstracts are reproduced from the weekly Patents Abstracts Journal *by permission of the Technical Information Co. The complete specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, price 3s. each.*

WHAT'S NEWS about

★ Plant
★ Equipment
★ Materials
★ Processes

This illustrated report on recent developments is associated with a reader service that is operated free of charge by our Enquiry Bureau. Each item appearing in these pages has a reference number appended to it; to obtain more information, fill in the top postcard attached, giving the appropriate reference number(s), and post the card (no stamp required in the United Kingdom).

Chemical control valve

Lined with a special form of 95%-pure rubber, a new, patented, flanged-type valve has been designed to perform all the complicated requirements of the control of abrasive and corrosive slurries, chemicals and vapours. The components are few in number, comprising a high-grade cast-aluminium body and handwheel, with brass and gunmetal working parts. Cast-iron bodies and handwheels are also available.

The slurries, chemicals or vapours are channelled straight through in the special rubber tube or, where chemical conditions dictate, in suitable synthetic tubes. Tubes are easily replaceable and a new sleeve will give the valve a new lease of life. **CPE 517**

Automatic filmstrip projection

Fully automatic slide and filmstrip projector attachments have recently been developed which should be found suitable for technical training, training of sales staff, exhibitions, etc. Fully automatic, it offers also the advantage that, when used for lecturing, the change of slides can be controlled at will. It should be found particularly useful in illustrating a sequence of operations of certain processes, whether chemical or mechanical.

The *Vidoscope* attachment converts a standard projector into a fully automatic filmstrip viewer, dispensing with the need for an assistant and being timed to show each picture for 12 sec. or any other desired time. It is fitted on to the standard filmstrip carrier by removing one bobbin and fixing the attachment in its place. A self-winding bobbin is provided on which short filmstrips may be shown quite automatically.

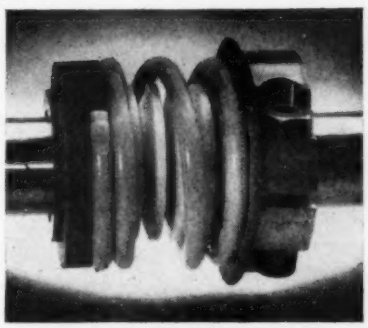
For frequent lectures the same filmstrip can be made into a loop. In this way the projector is always ready for lecturing without the necessity of rewinding the film each time. The film loop is held in position by a supporting frame which can easily be adjusted to take any number of frames from 22 to 50. Where more than 50 frames are used, additional bobbins can be added.

With *Rotoscope* no assistant is needed to change the slides. Twelve 2 × 2 in. transparencies are inserted into spring-loaded pockets of a slide wheel numbered for easy identification. The wheel is rotated by means of a small electric motor and is set to change the picture every 6 or 12 sec. A hand switch can extend the viewing time for any period. **CPE 518**

Mechanical shaft seal for corrosive services

The range of applications for mechanical seals in corrosive services is expected to be extended considerably by the development of a mechanical seal, now being patented, which makes considerable use of *Fluon* PTFE.

The main seal member is a bellows of pure *Fluon* to which running faces of glass-reinforced *Fluon* have been welded. Spring loading, to maintain contact between the seal faces and the seat (or seats), has been achieved by using a *Fluon*-sleeved spring.



PTFE mechanical seal.

The *Fluoseal* is designed for use with all concentrations of acids and salts, strong oxidising agents or reducing agents, and it is also resistant to all organic compounds and salts. The only services for which the seal is not recommended without careful study of the particular applications are those handling strong alkalis such as caustic solutions of more than 50% concentration, or acid fluorides such as potassium bifluoride or hydrofluoric acid; the application of the seal is also restricted when a fluid contains solids in suspension.

The normal pressure range is from 20 in. vacuum to 50 p.s.i., and the normal temperature range from –40°C. (–40°F.) to +80°C. (+176°F.). The seal may be run dry indefinitely if arrangements are made for dissipation of the heat generated at the seal faces into the seal housing or pump casing, which can be readily accomplished with the standard recommended clamp-type ceramic seat.

In the design of the *Fluoseal* account

C.P.E.'S MONTHLY REPORT AND READER SERVICE

has been taken of the dimensional discrepancies normally encountered in chemical pumps.

The range of sizes in which the seal is at present supplied is for ¾ to 2 in. diameter shafts, and there are two versions of the design.

For external mounting the seal unit, Type 10, is fixed to the shaft with a metal clamping ring, the latter not being in contact with the fluid and being protected from possible leakage by a thrower. In this case only one reinforced end of the bellows acts as a running face.

For internal mounting a double-ended seal, Type 12, is employed and both reinforced bellows ends act as running faces.

These seals have been tested in actual service on the following applications: 70% sulphuric acid at 100°F.; 90% nitric acid at ambient temperatures, and 20-ft. head; 5% hydrochloric acid and 2% sulphuric acid at 176°F. **CPE 519**

Electronic control of packaging

The problem of reconciling the stock of raw materials with the packaged output leaving the factory has been solved, according to the manufacturers of an ' electronic clerk.' This device, when fitted to the *Solarcheck* range of checkweighers in a production line, will show on the dials of a counting device, or through the output of an electronic digital computor, the exact weight of any package from less than ⅛ oz. upwards.

If, however, the device is connected instead to a card puncher, adding machine or electric typewriter of the teleprinter style, it can, with proper electronic adjustment, be made to work them wherever they may be. All that is necessary is a length of cable from the weighing device in the factory to the appropriate recording machine.

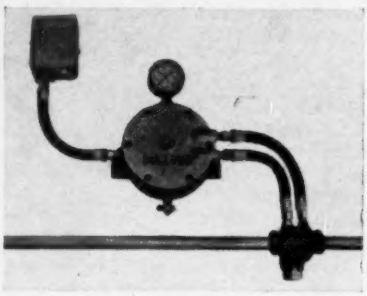
The checkweigher automatically weighs each package separately at the rate of 4 or 5/sec., if need be, and the converter enables this information about each package to be recorded. No human agency enters into the process anywhere, except to read the final figures.

The slight overweights, often necessary for a variety of reasons, are totalled and will be found to be largely responsible for the difference on paper between what goes into a factory and what comes out. **CPE 520**

Automatic fan control unit

The air exhausted from a workshop by a spray booth has been heated at considerable expense, and the displacement of air from the shop for exhaust purposes represents a serious heat loss from the factory.

An automatic fan control unit has now been announced which automatically switches the fan off when the spray gun is no longer in use, and switches the fan on again when spraying re-starts. In this way the fan is running only when spraying actually takes place, so that there is a substantial saving in heat losses as well as in electric power to run the fan. Time study shows that, in many spray booths, the operator actually uses his spray gun for only one-third of the day, the rest of his time being spent in handling material and preparation of his work and equipment. In most installations the exhaust fan is running all the time, so that it may be possible to save up to two-thirds of the existing heat loss.



Fan control unit.

The unit is very simple in construction. A slight local restriction is fitted in the main airline feed to the spray guns on the booth. The airflow caused by the spraying operation induces a slight pressure drop on the downstream side of the restriction, and the variation in pressure on either side of this is used to actuate a diaphragm cylinder, which in turn controls an air-feed valve to a small reservoir, and in turn to a pressure switch which completes the circuit for the fan motor. **CPE 521**

Getting rid of grease

A completely portable unit for degreasing small components is available which employs the use of compressed air from an ordinary air line to assist, speed up and improve the degreasing process.

The unit consists of a steel bucket, into which fits a strong galvanised-wire-mesh basket fitted with a tray on which the components to be degreased rest. Below the tray is an agitator unit made of brass.

The pressure unit is inserted into a bung in the side and the loaded basket placed in the bucket, which contains a special soluble solvent. The air supply is adjusted to ensure a steady turbulence of the fluid around the parts.

The capacity of the container is 6 gal. and the overall dimensions are 12 × 17 in. **CPE 522**

Low-heat input welding

Eutectic low-temperature welding alloys, supplied either as welding rods together with ' companion fluxes,' or electrodes with special *FrigidArc* coating, utilise the phenomenon of surface alloying during the welding process.

With the use of these special rods and fluxes, it is claimed, a unit of uniformly flawless construction and optimum physical properties can be obtained at welding temperatures considerably below the melting points of the metals to be joined.

The alloys are available in a wide range and can be used to treat a variety of metals. One high-strength, machinable electrode for alloy cast iron, for example, has been employed successfully in the repair of a 1½-ton casting which broke into four pieces. It formed the base of a bone-crushing machine and was subject to a tremendous amount of shock.

The metal was thoroughly impregnated with grease accumulated during its 30 years of operation, and the electrode selected proved ideal for such conditions. The rapid solidification of deposits sealed the metal and prevented the gas penetrating the deposits from forming pinholes and porosity. When reassembled, the crusher was found to work perfectly. **CPE 523**

Ultrasonic drilling, tinning and soldering

A new ultrasonic generator will be especially useful in applications where drilling, tinning and soldering operations are performed, since it enables compact dual- or triple-purpose installation to be achieved with economy Two outputs are provided: one for the drill and one for the soldering iron or tinning bath. The former is transformer-coupled to the transducer, the latter capacity-coupled.

Unlike conventional drilling methods, in which a rotary motion is imparted to the cutting tool, the tool of an ultrasonic drill vibrates with a reciprocating motion. Its action is, in fact, similar to that of an ordinary road drill, but with the important difference that the ultrasonically-driven tool acts on a finely granulated abrasive material, suspended in water, which is interposed between the tool and the workpiece. The abrasive particles are hammered against the workpiece by the reciprocating tool-tip and chip away minute parts of it.

Since the shape of the hole produced closely follows the shape of the tool, holes and patterns of any shape, no matter how intricate, can be cut with the greatest facility.

The ultrasonic tool is suitable for the machining of hard and brittle materials such as glass, ceramics, germanium, tungsten and titanium carbides, diamond, synthetic gems, and so on. The technique is not confined to drilling and piercing; it can be readily applied to most other machining operations, including shaping, grinding, polishing, etc. Great accuracy and very fine surface finishes are possible using appropriate abrasives. **CPE 524**

PREHEATER FOR PLASTICS

Industrial heating equipment of 1½ to 2 kw. output for preheating plastics, it is claimed, will comfortably preheat any load up to 2 to 4 lb. at the rate of 1½ lb./min. For example, it preheats 2 oz. in 13 sec. or 4 lb. in 2½ min. The material should preferably be pelleted but can be loose in a low cardboard box.

These preheaters have automatic lid opening which is claimed to save one second on every lift—up to one week in a year.

The new model is fitted with *Xenon* long life industrial rectifiers. **CPE 525**

New type of powder classifier.

Powder classifier

A completely new type of powder classifier which is the product of many years' intensive development research has been announced. In the field of dry classification, or the division of powdered materials into fractions according to particle size, the makers point out, there are three factors of vital interest to the chemical, minerals, metals and other industries.

These are cutpoint—the particle size about which the powder is divided; product recovery (yield)—that portion of the product available in the feed which is separated by the classifier; and capacity—the rated throughput.

The cutpoint of the new air-vortex-type classifier is claimed to be exceedingly precise. For example, fine fractions with a top size in the range of 15 to 20 microns will contain less than 0.01 to 0.04% 325-mesh-screen residue. Cutpoint sharpness is not affected by throughput rate or size distribution of the feed.

Product recovery, or yield, of the classifier varies from 80% to well over 90%, depending upon product requirements. Production runs on talc have been made with over 97% yield at a top size cutpoint of about 15 microns. As with cutpoint, the efficiency of the classifier is not affected by changes in throughput rate or size distribution of the feed. Because of this, high production capacities combined with high-quality product are easily maintained. With such high efficiencies, the circulating load on existing grinder systems is greatly reduced, and this makes possible an increase in product output without additional grinder capacity.

The classifier operates continuously without adjustment, and an absolute minimum of operator attention is required. To change from one cutpoint to another is a simple matter, requiring only the changing of two vane rings and a drive pulley—which takes less than an hour.

It is further pointed out by the manufacturers that great care has been taken in the design of the classifier to minimise the effects of wear. First,

those points at which there is high relative velocity between the powder and contacting surfaces have been held to a minimum. Second, where necessary, easily replaceable, inexpensive wear inserts have been provided. This combination assures minimum downtime and greater production.

The main industrial applications of the classifier fall roughly into three categories: topping, batch or continuous tailoring, and ore beneficiation. In the topping process, the most common application, the powdered material is divided into a fine and coarse fraction, one of which is the product. Typical topping applications are involved in the production of clays, talc, limestone, etc., for paint extenders, paper coatings, fillers, etc.

The tailoring application is used in the production of abrasives. The feed, usually from a grinder, is divided into several fractions, either by batch or in series-continuous processes. Used in beneficiation of kaolin, uranium ore, iron ore, etc., the classifier is set to separate the impurities from the ore in a customary topping operation.

CPE 526

New uses for bentonite chemicals

The use of *Hectorite*, which is a magnesium-lithium bentonite, and *Macaloid*, the beneficiated purified *Hectorite* ore, is being developed in the manufacture of emulsion paints, cleaners and polishes, oil-in-water emulsions, welding industry, cosmetic and pharmaceutical industries.

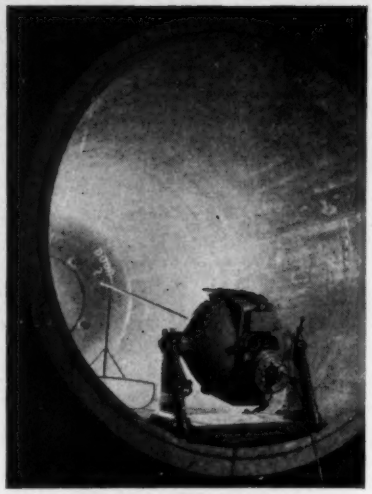
This product can replace gums and other organic materials, because of its dispersing, suspending, stabilising and film-forming properties. It has greater viscosity and emulsifying properties, and is of an inert nature. It does not develop or support bacterial growth, and is non-toxic. **CPE 527**

Reversing contactors for a.c. circuits

Alternating-current contactors for reversing as well as starting and stopping squirrel-cage motors consist of two standard magnetic contactors of the same range, electrically and mechanically interlocked to ensure that only one is closed at any time, mounted on a common base. One contactor connects the motor for forward operation and the other for reverse. A normally-closed auxiliary switch is mounted on each contactor and is wired in series with the opposite contactor coil.

Additional, normally-open or normally-closed auxiliary contacts for operation of remote pilot lights or interlocking with other apparatus are available, either in original manufacture or in packaged kits for later installation on site.

The contactors are of the vertical-action type and are fitted with double-break, silver-to-silver contacts. Five sizes are available, in current ratings from 15 to 150 amp., and they can be supplied either open or mounted in a general-purpose enclosure for indoor use in normal atmospheric conditions. The enclosure provides protection against accidental contact with live parts and can be padlocked to prevent unauthorised access. **CPE 528**



RADIOGRAPHY WITH ISOTOPES

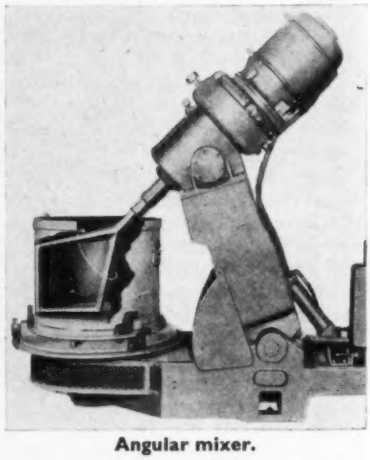
In the same way as a doctor uses an x-ray apparatus for diagnosis of internal troubles, the engineer uses radiographic units as a reliable low-cost means of inspection of welds and castings. Frequent costly breakdowns are prevented by this type of inspection, which is also a valuable aid in economising with materials or in the training of welders and foundrymen. Here is one of the world's largest isotope units built for this purpose. The source of radiation energy is a powerful gamma ray emitter, cobalt 60, supplied by the U.K Atomic Energy Authority. Its radiation is equivalent in penetration to that from a 3-million-volt x-ray machine. The radiation is emitted in all directions and a whole circumferential weld or a large section of a horizontal weld may be inspected simultaneously. The equipment is mobile, safe and operated by remote control. **CPE 529**

Angular mixer

A production mixer using an agitator that rotates on its angular axis while the container and its contents rotate on a turntable has recently been introduced. Known as the *Troy* angular mixer, it is stated that the relative movements of the can and agitator thoroughly and rapidly mix the ingredients of a batch to homogeneity.

Designed primarily for mixing paints and inks prior to milling, the mixer is claimed by the manufacturers to be adaptable to a number of other mixing applications. It is available in 5, 40, 60, 80 and 120 gal. capacities and with adaptors for smaller and intermediate sizes. All the mixers are available with stainless-steel contacting parts and jacketed for heating or cooling.

CPE 530



Angular mixer.

Storage drums in aluminium alloy

Patented aluminium-alloy storage drums—claimed to be the most economical method yet devised for packing and shipping many chemicals, foodstuffs and corrosive products—are available in a range of capacities from 5 to 90 gal. They are fabricated from magnesium/aluminium-alloy sheet and are automatically welded, without flux, using an inert-gas-shrouded arc. They are reinforced by mild-steel ' top hat ' section rolling rings, and a mild-steel chime ring, to prevent damage during transit. The weight is approximately one-third that of a comparable steel drum.

In addition to being corrosion resistant, the makers state, the light alloy drums are unaffected by chemicals which attack conventional steel drums. This enables materials, including cor-

rosive chemicals, oils, plastics and concentrated detergents, to be transported and stored without requiring special glass or stainless-steel containers, or the need for anti-corrosion drum linings. These drums are also being used widely as bulk containers for foodstuffs and other products which require an exceptionally high standard of cleanliness in all stages of handling.

Most of the drums are available in three versions—for heavy and standard duties and for export use. Closures are provided by patented secret rivetted flanges in either the body or head of the drum, and bungs can be in plastics or die-cast aluminium- or zinc-base alloys. **CPE 531**

EXTINGUISHER FOR METAL POWDER FIRES

Designed to meet the exceptionally difficult problems associated with fire outbreaks involving metals such as sodium and calcium, or magnesium and aluminium in the form of powder or swarf, a new, special-purpose fire extinguisher now being marketed is charged with 25 lb. of dry chemical powder which is discharged under pressure provided by a cartridge of CO_2 gas.

The dry chemical powder is applied to the burning metal by means of a specially-designed applicator comprising a long tubular metal extension terminating in a cone-shaped spreader. The applicator ensures that the discharge of dry chemical powder is delivered lightly on to the fire in order to prevent the danger of scattering which is associated with this class of fire.

Speedy operation is effected simply by removing the safety clip, detaching the applicator and striking the top of the extinguisher. A ' squeeze-grip ' control valve enables the flow of dry chemical powder to be shut off at will and to be used to its fullest advantage. **CPE 533**

Polythene protects fume cupboard fans

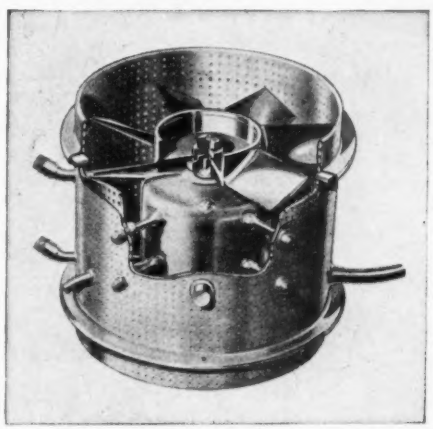
The method of protecting fans against corrosive gases by a coating of polythene is now applied to *Aerofoil* fans designed for fume cupboards.

As for other applications, the axial-flow design has advantages for fume cupboard extraction. Inserted directly into straight ducting, it enables exhaust systems to be kept simple and compact.

The new fume cupboard fans, made in three sizes, 6 in., 7½ in. and 9½ in. diameter, are completely protected with polythene inside and out. The motor and casing are hermetically sealed in a covering which is resistant to practically all corrosive reagents. To ensure adhesion of the polythene to the fan the casing is made from perforated steel and is coated on both sides. Thus polythene passes through the perforations, joining the inner and outer coatings and, as a result, the metal is sheathed within a homogeneous double skin.

The fan impellers are phenolic mouldings, inherently resistant to corrosion, and the hubs are designed to shield against the ingress of fumes into the motor through the spindle bore. The motors are fitted with a ' breathing ' tube which passes through the casing, giving access to clean air. The two smaller fans are driven by a newly-developed two-pole shaded-pole motor, the largest size by a capacitor motor. The lubricators are extended to the outside of the casing, and the fans are connected to the electrical supply by leads, 3 ft. in length, taken out through a hole in the casing which is sealed with polythene. Supporting studs with polythene caps are provided on the casing for carrying the fan on brackets.

Connectors moulded in *Neoprene* are supplied for connecting the fan to the fume cupboard and to ducting. **CPE 532**



' Aerofoil ' 9½ in. fume cupboard fan.

PROTECTION FOR WELDERS

This new welding helmet is a one-piece construction with the shape streamlined to improve both comfort and appearance. The deeply curved sides give good protection against sideflash and reflected radiations and the total weight of the helmet, with filter and cover glass, is only 23 oz.

The glass holder is of shock-resistant plastic and takes filters size 4¼ in. × 2 in. The coloured filter is of Protex *glass to B.S. 679: 1947, and is protected by a clear cover glass.* **CPE 534**

Vial and ampoule printing

A machine has recently been developed for printing cylindrical objects, particularly ampoules and glass tubes, which is claimed to be of entirely new design. It is mounted on a stand and is complete with hopper, discharge conveyor and speed regulator. The double inking offset method using metal stereos is claimed to give excellent quality and the conveyor enables

containers printed with quick-drying ink to be packed directly without the need for a drying process.

The drive mechanism is completely enclosed. The printing mechanism has a *Perspex* guard which makes the printing process clearly visible. The operator loads the objects to be printed in bulk either into the hopper or into the ramp from where the machine is fed automatically. The hopper is used for small objects, the ramp for large ones.

The range of the machine covers diameters from $\frac{5}{16}$ to $1\frac{3}{8}$ in. and the output, depending mainly on work diameter, is 70 to 100/min. **CPE 535**

Positive-displacement flowmeter

A new addition to a U.S. company's range of instruments is a positive displacement flowmeter suitable for hard-to-handle fluids such as bunker oils, still bottoms and asphalt. It is described as a high-accuracy meter designed to meet the needs of the chemical and petroleum industries and is capable of operating at elevated temperatures and pressures with fluids of high viscosities, either lubricating or non-lubricating.

The meter operates on the principle that the quantity of liquid displaced by each stroke of a piston is constant and the number of strokes may be integrated by a counting mechanism. In practice, the meter is fitted with four single-acting pistons arranged in such a way that each piston controls the actions of the others—the pistons then act as sliding valves. **CPE 538**

Cementable PTFE tape

The non-stick properties of PTFE are well known and for this reason it has not been possible hitherto to bond this material satisfactorily. Sprayed coatings on to shot-blasted surfaces have provided a partial answer, but the tendency to porosity has limited its usefulness.

By chemically treating one surface of the PTFE tape it is now possible to bond it to a variety of materials using readily available adhesives.

The material is available in various thicknesses from 0.005 in. to 1 in.; in tape form up to 12 in. wide and in sheets up to 34 × 34 in. The bonded film is completely impervious. It will stand up to high-frequency spark testing and has a temperature range of −110 to +500°F., and is completely inert to all chemicals except molten alkali materials and fluorine. Water absorption is zero and the static coefficient of friction against polished steel 0.09 to 0.12.

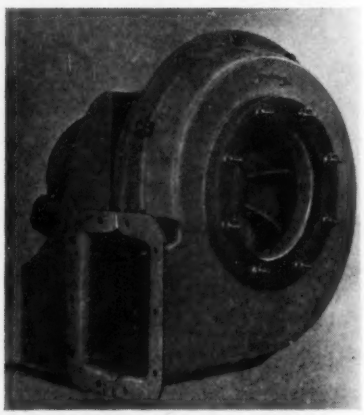
Cold-setting epoxy resins provide excellent adhesion to metals, glass, wood and most plastics.

Cementing of the tapes to various shapes of metal can be easily carried out by unskilled labour.

CPE 536

PVC fume removal fans

Solid PVC fume removal fans are now available made with 6-in. and 12-in. impellers. They are direct driven by a totally enclosed motor, wound for 400 to 440 v., 50 c., three-phase supply with left- or right-hand bottom horizontal discharge.



Centrifugal fume removal fan.

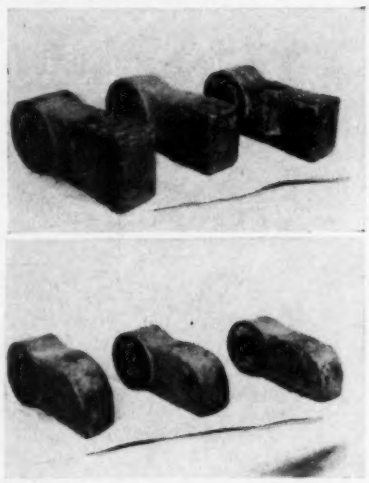
The fans have a fume-handling capacity of 50 to 180 cu.ft./min. at pressures up to 1.25 S.W.G. Fumes up to 120°F. from such chemicals as butadiene, fatty acids, hydrogen peroxide and sulphuric acid (up to 90%), as well as many others, the makers claim, can be handled safely by these fans. **CPE 539**

HARD FACING FOR NEW AND LONGER LIFE TO METAL PARTS

Hard-facing welding rods can be used for reclamation of worn parts, but they are also extremely useful when applied to new parts and increases in the normal life of equipment in the region of 700 to 1,000% are not unusual, thereby saving frequent repairs and replacements. As a result, equipment is available for production longer and idle labour time is saved.

In many cases hard facing results also in saving of first cost. The base metal of hard-faced components can be made from a cheaper, plain or medium carbon steel, which provides the necessary strength and impact resistance for the part, tool or implement. Then by hard facing the wearing surfaces with a thin layer of Endewrance *alloy, which is resistant to severe wear and abrasion, a greatly superior as well as inexpensive construction is obtained. A wide range of rods is manufactured, designed to withstand specific surface conditions.*

Materials suitable for hard facing seats and discs of valves, pump sleeves, shafts, vegetable oil mill expeller screws, rubber extrusion equipment, fan blades are of particular interest to the chemical plant engineer. **CPE 537**



A set of hammer mills used for grinding manganese oxide. *Below:* **uncoated hammers worn.** *Above:* **same hammers hard faced.**

Carbon ejectors for corrosives

The universal suitability of carbon for handling all types of corrosive liquids has led to the development of carbon ejectors or siphons for emptying tanks of pickling liquor and similar corrosive fluids.

Pickle tanks are generally situated below ground level or are not provided with side outlets, so that the acid

must be emptied from the top of the vessel by means of a pump or ejector. Tanks are usually emptied at intervals such as weekly or monthly and a pump, if fitted, would only operate for very short periods with long intervals of idleness. This is wasteful and costly, since a pump suitable for handling dirty pickling liquor is unlikely to be adaptable to another duty.

A range of carbon ejectors of both water-operated and steam-operated types is now available. These ejectors are capable of handling all corrosive fluids, and particularly waste pickling liquors heavily contaminated with crystals, shale, etc., at high discharge rates. With the water-operated types, low-pressure water is suitable and waste liquor can be discharged directly to the neutralisation plant or to waste.

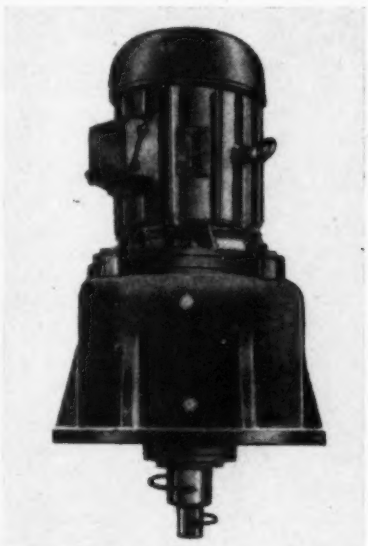
The makers state that the ejectors are very robust, both mechanically and thermally. There are no moving parts and all carbon parts are completely protected by the cast-iron casing. **CPE 540**

Carbon water-operated ejector.

Level controller for conductive solutions

The *Aquatrol* is the latest in a line of level control and indication instruments and has been developed expressly for the control of aqueous solutions. It is claimed to provide simple, safe, and sensitive alarm indication, and/or on/off control of electrically conducting liquids. It is suitable for the level control of acids, solutions of salts, effluent, etc.

When suitable probes, connected to the electronic unit, make or break contact with the liquid under observation the relay incorporated in the unit opens or closes as required. The relay contacts may be so connected as to operate visual or audible warning systems, as well as pump motors, or any other control function required by the particular application. **CPE 542**



CONTRA ROTATING SHAFTS FOR MIXERS

The makers of a range of geared motors and speed reducers announce their contra rotating coaxial shafts as being of particular interest to industries concerned with the mixing of materials and liquids. These units consist of a hollow shaft with an internal solid shaft, each sealed against oil leakage, and contra rotating at the same or different speeds. They are available as flange or foot mounting units, with or without motors, from $\frac{1}{8}$ *to 25 h.p.* **CPE 541**

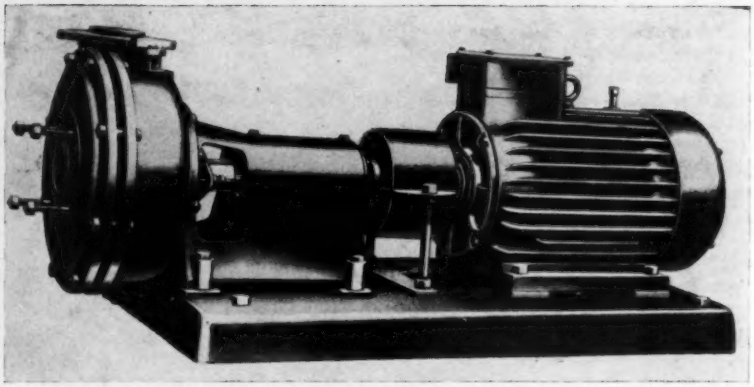
Stoneware centrifugal pump

There are several advantages in employing stoneware for contact surfaces in the handling of acids, alkalis and other corrosive liquids. The centrifugal principle as applied to pumping is often the most simple and efficient method. Technically, however, there are many obstacles to overcome when combining the two, that is in designing and constructing an efficient centrifugal pump with non-corrodible contact surfaces of stoneware.

Two firms joined forces to tackle this problem and the result was a stoneware pump, which is marketed in three sizes, covering quantities from 1 to 450 gal./min. and heads up to 140 ft. The manufacturers state that the design fully meets the limitations of stoneware as a constructional material, as the pumps are completely resistant to the severe conditions encountered. All the interior parts are made of stoneware. There is, therefore, no contamination or discoloration of the product.

The type of stoneware employed for the impeller is stated to be of a special grade of *Corundum* ware with an exceptionally low degree of porosity. This specific material is appreciably harder than ordinary acid-proof stoneware. The pump is carried by a hood, forming a rigid support for both it, the two bearings and the shaft. The latter is of a large diameter, giving freedom from distortion and vibration when working. The impeller is of the 'single-inlet shrouded type.' It is balanced to run without vibration and is securely fixed to the spindle. The boss extends right through the stuffing box, thus protecting the spindle. A water thrower and dust cap of the *Labrynth* type are provided to prevent acid liquid from entering the bearing from the gland fitting, while each bearing also has its own grease nipples, the shaft between the bearings being

fully protected against accidental contact with the acid product. Driving may be by various means, such as direct motor drive with flexible coupling, overhung flat or grooved pulley, or overhung fast and loose ball-bearing pulley. Rotation is anti-clockwise when looking towards the driven end. **CPE 543**



Stoneware centrifugal pump.

GRINDER-POLISHER

A new two-speed, fine grinder-polisher has been developed. The manufacturers state that it is a precision-built instrument, free from vibration, which is delicate and thorough in its operation. This is a necessary quality, as the most careful grinding on the finest available abrasive papers is an essential requirement prior to final polishing.

It is claimed that all grits of abrasive papers or cloths of various types can easily be held in position on the polishing wheel by means of special holding clamps. The 8-in.-diam. polishing wheel of phosphor bronze is balanced and directly driven by a ¼-h.p., single-phase, two-speed motor. The motor is fitted with special thrust bearings and operates at 700 and 1,400 r.p.m. The machine is for table-top mounting, but can also be supplied, at the same price, for counter-sinking into a table top, by equipping the unit with a flanged bowl. **CPE 544**

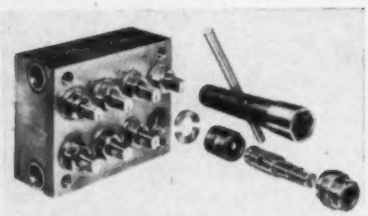
Industrial floor coating

An entirely new type of floor coating, which the makers claim to be the answer to all the problems hitherto associated with the treating of floors in all kinds of industrial premises, has now been introduced commercially.

This product, *Exon*, is not a floor paint. Instead of lying on the surface as a vulnerable film, it is stated to penetrate into concrete, stone and similar floors. As a result of this sub-surface penetration, *Exon* has good durability. One of its properties is to give added hardness to treated surfaces, thus increasing resistance to abrasion; by preventing surface disintegration of concrete it eliminates the creation of dust.

The preparation is claimed to resist both acids and alkalis in moderate strength and is not affected by paraffin, kerosene or petrol spillage, or by splashes of oil and grease.

No solvents are required with it since, when necessary, it is thinned—as for spray applications—with water. It dries quickly—normal traffic can be resumed after only 3 hr. The finished surface is semi-matt and non-slip with enough sheen for quick and easy cleaning. The standard colours available are stone, grey, tile-red and white. Any special colours can be supplied to order. **CPE 546**



MANIFOLD COCKS AT CALDER HALL

Specially designed and manufactured for the U.K.A.E.A. Calder Hall Pile, these cocks are of a three-way design and are ganged together in the form of an eight-unit cock manifold arranged in two groups of four.

Shown here is an eight-unit A.B. 18 cock manifold with one of the cocks dismantled to show its various parts. The split ring fits into the groove at the bottom of the plug and locates it firmly in an axial direction when the compressed asbestos packing sleeve is forced against it by means of the tightening nut. The body and the plugs are made from wrought stainless steel. The square ends of the plugs are unsymmetrical and a special operating key is provided to ensure that the ports in the cocks are positioned correctly. When the operating key is reversed it provides a box spanner which is used to tighten the nut compressing the packing sleeve. A special extracting tool is supplied for removing the plug from the body should the cock require repacking. All pipe connections are welded and an annular recess is machined around each connection in the body to relieve welding stresses. In order to prevent the risk of any leakage whatsoever, each group of four cocks is covered by a sealed bonnet which is only removed when the cocks are to be operated. **CPE 545**

PROCESS REFRACTOMETER

In the U.S. a new automatic process refractometer, for end point analysis and control in the chemical, petroleum, pharmaceutical and food processing fields, has been announced. Hundreds of applications are possible, as the instrument is able to plot refractive index changes in any non-opaque liquid or gas stream. A few of the many applications include: checking and controlling product purity; measuring and controlling the blending of two streams; measuring and controlling concentrations of gases and solids in solutions; identifying compounds as they are released from fractionators, stills, and chromatographic columns. **CPE 547**

World News

WESTERN GERMANY

Automation in chemical works

The Chemische Werke Hüls A.G., of Mart-Hüls, recently floated an industrial loan of DM. 40 million to finance further measures of automation in their chemical works. Three automatic plants are already in operation: a sulphuric acid recovery plant; a plant for the production of acetylene oxide; and a unit manufacturing acrylonitrile. These three plants are controlled centrally and require only a few directing staff. The company have also decided to set up an experimental plant for the production of *Vestolen*—a low pressure polythene, using the Ziegler process—which they have developed in conjunction with the coal mining company Hibernia A.G. The plant will produce 50 tons of *Vestolen* a month.

MEXICO

Formaldehyde plant

Celanese Mexicana S.A., an affiliate of the Celanese Corporation of America, has started construction of a new chemical plant near Mexico City for the manufacture of formaldehyde and the formulation of synthetic resins derived from that intermediate raw material.

The new plant, located 12 miles north of Mexico City at San Cristobal Ecatepec on the Mexico-Laredo highway, will provide components used in the manufacture of plastics and the finishing of various textile products.

NORWAY

Cellulose project

Finland and Norway have agreed on a scheme to build and operate a sulphate cellulose factory in the Varanger district of Northern Norway. Officials of the two countries approved the plan during recent negotiations in Oslo when ways of utilising the extensive timber resources on the Finnish side of the border, in the Enare region, were discussed.

A joint Finnish-Norwegian technical committee will be set up to estimate the cost of the new roads which will have to be built in connection with the project. At the same time, Norwegian experts will work out the cost of building the factory itself, while the Finns will calculate the probable cost of providing the raw material needed. The joint committee will meet for further talks in Helsinki when these estimates have been prepared—it is hoped not later than early April.

Present plans are for a factory with an output capacity of some 30,000 to 40,000 tons p.a. of cellulose.

JAPAN

Vinyl chloride statistics

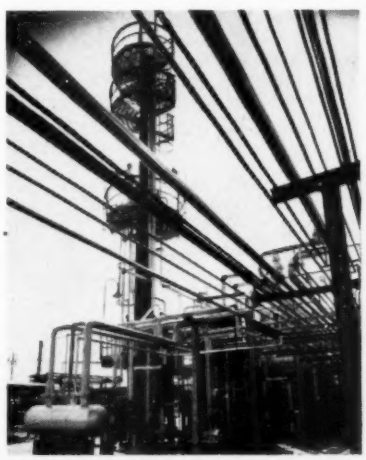
Japanese vinyl chloride production in 1956 totalled 55,819 tons against 32,210 in 1955, the Japan Vinyl Chloride Association reports. Deliveries in 1956 totalled 55,819 tons against 33,615.

Exports amounted to 2,500 tons against 1,889 in 1955. Of this, 1,200 tons went to the U.S.

The Association says that domestic needs for vinyl chloride are so active that manufacturers are having difficulty in keeping up with demand. This is due particularly to a scarcity of raw materials such as carbide and salt caused by the electric power shortage.

Vinyl chloride is used in Japan for products such as films, artificial leathers, cloths, pipes, sheets, hard boards, covering of electric wires and fishing nets.

Although vinyl films must compete with polythene products, requirements for vinyl products would be sufficient to enable production of vinyl chloride to increase to 100,000 tons in 1957, the Association says.



Process pipes and distillation tower of a section of Celanese Corporation of America's new polyolefin resin plant.

CANADA

Sulphur recovery project

An agreement to operate a pilot plant at Copper Cliff, Ontario, to study processes for recovery of sulphur from sulphur dioxide bearing gases has been concluded by the International Nickel Co. of Canada Ltd. and the Texas Gulf Sulphur Co. The pilot unit, to be built near Inco's new iron ore recovery plant, will consist of two sections—gas cleaning and scrubbing facilities and a sulphur dioxide reduction unit.

The Inco iron ore recovery plant was built to separate iron ore from iron sulphides present in the Sudbury, Ontario, nickel ores. The new pilot plant will use sulphur dioxide given off in the production of iron ore.

Natural gas, when it becomes available, propane gas and heavy fuel oil will be investigated by Texas Gulf as reducing agents in the pilot plant. The elemental sulphur will be sold to a $3 million sulphuric acid plant to be built by Canadian Industries, Ltd., adjacent to the Inco operation.

Natural gas expansion programme

The Westcoast Transmission Co. Ltd., which built a $170 million pipeline to carry natural gas through British Columbia to the U.S. border, has announced plans for a $100 million expansion programme. The programme will include the construction of a new sulphur plant in south-western Alberta and a 170-mile pipeline from newly-discovered gas fields in southern Alberta to the U.S. border at south-eastern British Columbia.

The company has signed a contract with the Phillips Petroleum Co. of Bartlesville, Oklahoma, which owns the new gas fields, to pipe the gas to the border. Another contract was signed with the Pacific Northwest Pipeline Corporation of Houston, Texas, for the export of gas piped through British Columbia.

£350,000 sewage plant contract

One of the most modern sewage plants in the world is now being built at Humber Valley for Toronto City. The sewage will be treated to a high standard by the activated sludge process with stages of settlement, aeration and digestion. The effluent will be discharged into the Humber river. The rotary blower engines to the aeration tanks are driven by gas produced during the digestion process but the plant has the unique feature of being able to use natural gas if the sludge gas is insufficient. The plant will drain an area of $5\frac{1}{2}$ sq. miles with a dry weather flow of $28\frac{3}{4}$ million

gal./day and serve a population of 265,000. In fact the design is capable of treating a daily average of 50 million gal. for a population of nearly half a million.

The machinery contract for the power plant is valued at over £350,000 and has been awarded to a subsidiary company of the Brush Group.

SPAIN

Increased fatty acid production

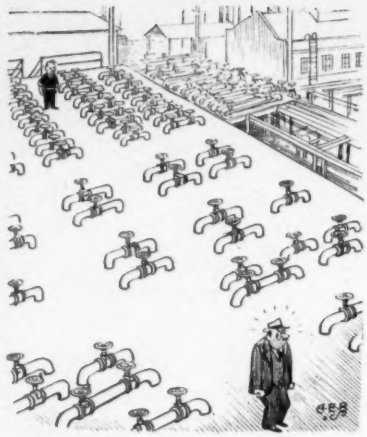
Revalorizacion de Aceites y Grasas have been authorised to accept participation of up to 50% capital by Archer Daniels Midland Co., of Ohio, U.S.A., towards increasing their production of glycerines, fatty acids, industrial oils, fat alcohols, etc.

PHILIPPINES

Ferro-nickel industry

Plans for a large-scale ferro-nickel industry were substantially encouraged by Philippine President Ramon Magsaysay's 'State of the Nation' message to Congress in which he recommended opening the large nickel-iron deposits in the Government reservation at Nonoc Island, Surigao Province to private mining companies.

Located in the southern Philippine island of Mindanao, it is reported to contain enormous deposits of nickel which can be expected to produce around 50 million pesos' worth of ore p.a.



"TURN OFF WHICH ONE, DID YOU SAY?"

Mining experts in Manila say the Philippines have a ferro-nickel production potential of 1 million tons. These deposits of nickel would be needed for the country's steel industry expansion, along with the large-scale exploitation of its vast iron ore deposits and their processing into steel. It is estimated that it will take at least five years for a metallurgical industry of this size to go into full production.

Should Congress act on the President's recommendation and pass appropriate legislation to open up the Monoc reserves this year, it will be 1962 before the industry can be expected to start producing dollars.

Another factor that tends to enhance the possibility of establishing a ferro-nickel industry is the large potential low-cost hydro-electric power now being made available with the construction of new hydro-electric plants in the northern and southern Philippine islands.

UNITED STATES

New Pennsalt plant completed

Completion of a major plant addition at Pennsalt Chemicals' Calvert City, Kentucky works marked the introduction of *Isotrons*—the company's new line of aerosol propellents and refrigerant gases. A second *Isotron* unit, it has been announced, is under construction and scheduled for completion later this year. Both projects are part of a $55 million expansion programme.

The main features of the process are the vapour-phase catalytic converters which produce the non-toxic *Isotrons* from hydrofluoric acid and carbon tetrachloride feed materials.

Polyolefin resins

The new resin *Fortiflex*, to be produced by Celanese Corporation of America at its new 40 million lb. p.a. plant near Houston, Texas, is made under licence from Phillips Petroleum Co. and is an ethylene polymer. Products made of *Fortiflex* will resemble in some respects those made of polythene, but, according to a Celanese spokesman, will provide properties enabling it to be used in many fields now barred to polythene.

Copper powder for fabrication

E. W. Bliss Co., has acquired a 20% interest in Chemetals Corporation, a research and development organisation principally concerned with the production of copper powder by chemical means and the fabrication of copper strip, tubing and other wrought shapes directly from the copper powder.

Bliss already operates a pilot plant employing the Chemetals processes. The new holding has been made to exploit the powder rolling method, according to Mr. Robert Potter, president of Bliss and a director of both firms.

The copper powder rolling process

The Leonard Hill Technical Group—March

Articles appearing in some of our associate journals this month include:

Food Manufacture—Fruit and Vegetable Canning; The Estimation of Ascorbic Acid in Foods; Artificial Flavours — Some Aspects of the Science and Art of the Flavour Chemist.

Paint Manufacture—Preview of the Oil and Colour Chemists' Exhibition; The Paint Industry in Perspective; Paint and Lacquer Additives; Mica in Paints.

Dairy Engineering—Mechanical Handling Developments in the Dairy; Planning the Larger Dairy; A New Hard-wearing and Corrosion-resistant Flooring; Some Comments on Cheese Grading.

Corrosion Technology—Corrosion-resistant Floors; Use of Plastic Conduits in Electrical Installations; Strippable Coatings; Corrosion: Its Causes, Cost and Prevention; Basic Research into the Linear Thermal Expansion of *Teflon;* Corrosion of Steel Piling in German Canals.

Manufacturing Chemist—Fire Protection in Chemical Works; Chemical Fire-Fighting; The Manufacture of Fire-extinguishing Chemicals; Fire Protection Equipment and Products; Fatty Acyl Alkylolamides, 1; Progress Reports.

Automation Progress—Work Handling Between Machine Tools; Background of Automation in the U.S.S.R.; Digital Computers in Oil Refining; Ultrasonic Machining, 2; Continuous Weighing Problems; Photoelectric Control of Colour Printing; Automatic Loading of Gear Hobber and Shaver.

Atomics—Liquid Metals and Nuclear Power; Nuclear Power and Gas Turbines; Radio-Carbon Dating; Welding in the Atomic Energy Industry; Zirconium and Atomic Energy.

Petroleum—Middle East Pipelines; A Pipeline Communication System; The Radio Systems Used in the Trans-Iranian Pipeline; Problems of Pipeline Laying; Manufacturing Detergents; Cutting Oil.

Fibres—The Search for and Production of New Fibres, 3; Heat Transmission of Fabrics, 2; Electrostatic Flock Printing; Weft Spinning in Automatic Looms; Bulked Yarns; Latex and Rubber Spreading and Processing.

World Crops—Ley Farming in the Australian Wheat Belt; Grassland Improvement; Herbage Legume Research at Aberystwyth; Rice Growing in Australia; Behaviour of Radioactive Contamination in the Ground.

NEW FUSED SODA ASH CONTAINER

'Purite' fused soda ash for foundry use is now being shipped by Olin Mathieson Chemical Corporation in non-returnable, specially-designed pallet boxes which reduce car-unloading time by as much as 90% compared with bag and bulk shipments. Holding 700 lb. each of the fused ash, the boxes are of open-top wooden construction with wire binding reinforcement. The special pallet bottom permits easy handling, either singly or two at a time, by a standard fork lift truck. In storage, the full boxes may be stacked four-high without crushing or buckling. 'Purite' is used for fluxing, desulphurising and refining of both ferrous and non-ferrous metals.

enables the powder to be fabricated directly into copper or copper alloy end-products without melting the powder into 'cake' or ingot. The ability to fabricate directly from powder is claimed to avoid a lengthy series of rolling operations and annealings, with savings in capital equipment and operating costs said to amount to 70 to 80% of the costs of conventional methods.

GREAT BRITAIN

British chipboard plant bought by Czechoslovakia

Czechoslovakia has ordered from Great Britain a complete plant costing approximately £600,000 for making chipboard or particle board by the Bartrev process. The order was secured in Prague by Mr. G. H. Lowe, managing director of International Plastics (East) Ltd. and Mr. M. Culme-Seymour, sales director of International Plastics Ltd. This is the third Bartrev press to be sold to Eastern Europe, two having previously been sold to Russia, the total contract being worth £1¼ million. The first of these has already been shipped to Russia, and is expected to be in production by the middle of this year. Further Bartrev presses are under construction, or planned, in other countries.

The Bartrev process, recently selected in a D.S.I.R. report as an example of automation, is a unique process for the continuous production of chipboard or particle board from wood waste and synthetic resin.

C.W.G. equipment for Japan

An order for the installation of two carburetted water gas sets at the Kobe works of the Osaka Gas Co. has been received by the British firm Humphreys & Glasgow Ltd.

Both sets have been specially designed for heavy oil enrichment and the total output of the installation will be 10½ million cu. ft./day of carburetted water gas. The value of the order is approximately £250,000.

The major part of the plant will be built in Japan and special equipment will be supplied from the U.K. by Humphreys & Glasgow Ltd. The installation is expected to be completed and put into operation early in 1958.

Search for natural gas in Yorkshire

Imperial Chemical Industries Ltd. have recently agreed with B.P. Exploration Co. Ltd., the exploration subsidiary of the British Petroleum Co. Ltd., to undertake joint exploration for natural gas in the Whitby (Yorkshire) district.

The conclusions from seismic reflection surveys which have been carried out are held to justify further drilling for natural gas, and as a first step it has been decided to deepen a borehole at Robin Hood's Bay which was originally drilled by Fisons Ltd. in 1949-50 during the search for potash. The limestone formations in which natural gas may be present lie several hundred feet below the potash beds.

These operations are not related to the search for natural gas at present being conducted over a very much larger area by the Gas Council, for whom B.P. Exploration Co. are acting as consultants and operators.

I.C.I. projects

Imperial Chemical Industries Ltd. are to increase production of *Terylene* polyester fibre to 30 million lb. p.a. by extending sections of the *Terylene* plant at Wilton in North Yorkshire.

Work will begin in the Spring of 1957 and additional quantities of *Terylene* will become available early in 1959.

Meanwhile construction of I.C.I.'s new *Topanol* O plant is now under way at Billingham. The new plant will be in operation by mid-1958 and has been designed to produce 1,600 tons p.a. of this important lubricating oil and gasoline antioxidant. The present plant is producing a substantial part of total United Kingdom requirements and installation of this extra capacity forms part of I.C.I.'s drive for additional exports.

Northern Ireland synthetic rubber plant

The Du Pont Co. (United Kingdom) Ltd. has announced that, having received the necessary approvals of the Bank of England and Capital Issues Committee as to financing, it has decided to proceed with construction of the neoprene synthetic rubber plant in Northern Ireland, indicated last November by the proposed acquisition of a trust of land near Londonderry. Start of construction is scheduled for mid-1957.

SWEDEN

Chlorine and caustic soda plant

A new chlorine and caustic soda factory, now being built at Stroemsbruk in Central Sweden, is expected to start production this year. The plant is being built for Stroems Bruks A/B timber, pulp and wallboard plant factory.

INDIA

New chemical company

A new company, Indian Electro Chemicals Ltd., has been formed in association with the Italian firm of Montecatini to establish a plant near Ahmedabad. Production targets are: hydrogen peroxide, 700 tons p.a.; sodium hydrosulphite, 1,500 tons and liquid sulphur dioxide, 2,000 tons p.a.

Atomic energy developments

Reviewing the work of the Atomic Energy Department during 1956 the Indian Prime Minister said in the Lok Sabha that considerable progress had been made in setting up the second (Canadian assisted) reactor at Trombay. It is expected to be operating by 1958 and will enable India to undertake advanced research and material testing. Twenty-one tons of heavy water from the U.S.A. have already been purchased and negotiations for a further 20 tons are under way.

In order to meet the demand for thorium the capacity of the monazite processing plant at Alwaye is to be doubled. Plant and machinery for the proposed uranium processing plant is being ordered. The capacity of the thorium-uranium plant at Trombay has been increased five-fold to supply thorium nitrate and to feed the proposed uranium processing plant.

IRAQ

Fertiliser plant planned

The Development Board have invited various consultants from Britain, France, the United States, Germany, Belgium, Italy and Switzerland to quote for the design and construction of a fertiliser plant at Basra with an initial capacity of 250,000 tons of ammonium sulphate. The cost of the plant is estimated at over ID. 7 million.

SWITZERLAND

Superphosphate imports

The Association of Swiss superphosphate importers and Swiss fertiliser manufacturers have agreed to prolong their year-old agreement on limited superphosphate imports for a further 12 months. The agreement —aimed at protecting domestic production—limits the total 1957 superphosphate imports at 8,000 tons.

While yearly imports between 1951 and 1955 averaged 9,500 tons, domestic consumption of superphosphate has been falling. It amounted to 16,900 tons in 1956, compared to 17,850 tons in 1955. Importers were told that a fall in consumption during 1957 would affect only domestic production.

The new factory of K.D.G. Instruments Ltd. at Crawley, Sussex.

MEETINGS

Institution of Chemical Engineers

March 14. 'Disposal of Long-lived Fission Products,' by J. R. Grover, 7 p.m., Reynolds Hall, College of Technology, Manchester.

March 20. 'A Study of the Motion of the Solid Phase in Liquid Fluidised Beds,' by N. L. Franklin and D. Handley, 7 p.m., The University, Leeds.

April 2. 'The Aqueous Homogeneous Reactor,' by R. Hurst, 5.30 p.m., Royal Institution, Albemarle Street, London, W.1. Meeting held in conjunction with British Nuclear Energy Conference.

Society of Chemical Industry

Chemical Engineering Group

March 11. 'A Survey of Industrial Filtration,' by A. P. Hosking and K. C. Salter, 5.30 p.m., 14 Belgrave Square, London, S.W.1.

April 2. 'Some Applications of Statistical Control to the Chemical Industry,' by A. G. Baker, 5.30 p.m. (as above).

Institution of Mechanical Engineers

March 29. 'Rotary Shaft Seals—The Sealing Mechanism of Synthetic Rubber Seals Running at Atmospheric Pressure,' by E. T. Jagger, 6 p.m., 1 Birdcage Walk, Westminster, London, S.W.1.

Chemical Society

March 11. 'Automatic Control and the Chemist,' by the Right Hon. the Earl of Halsbury, 6.30 p.m., Chemistry Lecture Theatre, The University, Leeds. Royal Institute of Chemistry Lecture.

March 21. 'Terylene,' by Dr. P. T. Barrett, 7 p.m., The University, Bristol.

March 26. 'General Uses of Ion-Exchange Resins,' by Dr. T. R. E. Kressman, 7.15 p.m., Queen's University, Belfast.

Incorporated Plant Engineers

March 21. 'Pumping Plant in the Field,' by H. P. S. Paish, 7 p.m., College of Preceptors, Bloomsbury Square, London, W.C.1.

Institute of Metals

March 18. 'Materials of Construction in the Heavy Chemical Industry,' by F. M. Keating, 7.30 p.m., Engineering Lecture Theatre, The University, St. George's Square, Sheffield.

Institution of the Rubber Industry

March 12. 'Fluorinated Elastomers,' by Prof. M. Stacey, 7 p.m., Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1.

March 13. 'Polyesters and Isocyanates in the Rubber and Plastics Industries,' by Dr. J. T. Watts, 7.30 p.m., Royal York Hotel, George Street, Bath.

INTERNATIONAL CONFERENCES

March 11-13. Thirteenth Annual Conference of the National Association of Corrosion Engineers, St. Louis, United States.

April 7-12. 131st Meeting of the American Chemical Society, Miami, Florida.